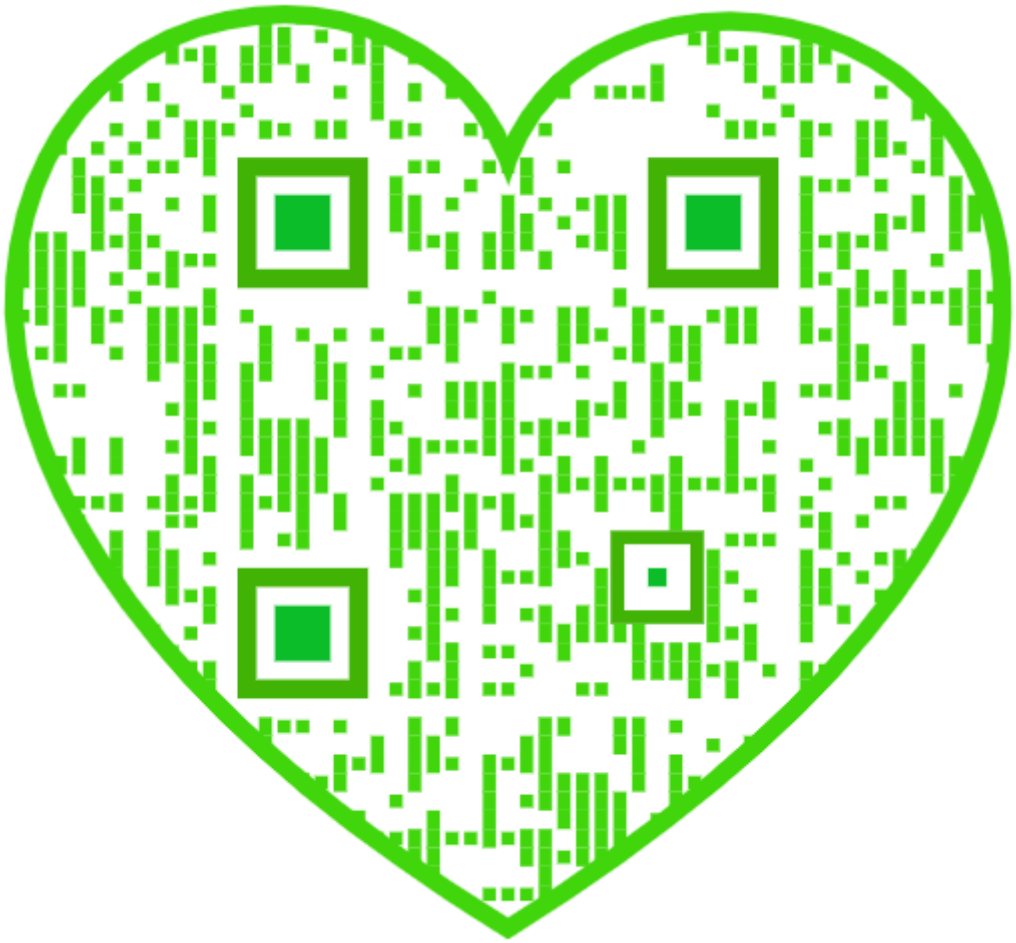
BEE-KEEPING
FOR PROFIT

W. S. MORLEY.



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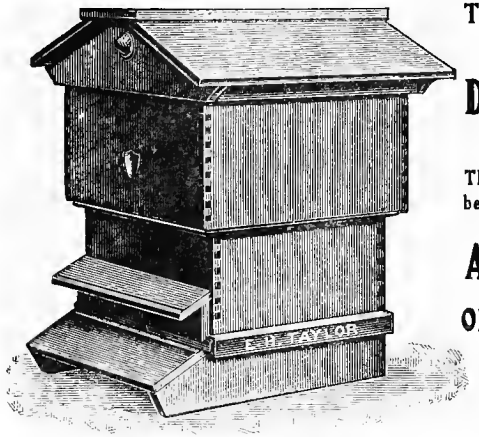

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How to Handle a Frame

BEE-KEEPING FOR PROFIT

BY
W. S. MORLEY

WITH EIGHT PLATES

CASSELL AND COMPANY, LTD
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INTRODUCTION

It is only in comparatively recent years that attention has been given to bee-keeping on a scientific basis. Aforetime there were certain traditional methods to be followed to secure the honey harvest, but those who practised them knew neither the why nor wherefore. To-day, however, thanks to the observations of our great scientists on the life and habits of the bee, to their patience and diligence in noting the insect's manner of working, we are in possession of knowledge which has enabled the practical bee-keeper to reduce the old haphazard ways to method, orderliness, and definite purpose.

The budding bee-keeper, as he reads one or other of these great works on the bee and its ways, may begin to wonder if it is not all too wonderful for him to deal with, and if he may ever hope to become proficient in the art and practice of bee-keeping. Let me say, here and now, that, given patience, perseverance, and diligence, a measure of success is open to anyone who brings intelligence into his work. Al-

though the doubts and difficulties that assail the tyro, and the questions arising therefrom, might raise a smile from the expert—if only as a reminder of his own early aspirations and efforts—yet there is no reason for despair; though disappointments are certain to arise, they should be accepted merely as spurs to further effort, as steps towards the ultimate goal of success.

Some may think—rashly—that there is nothing new to be said or learned about the bee, but the fact is that even scientists are still ignorant as to the definite uses of certain of the insect's organs, and of the origin and remedies of some of the diseases from which it suffers. Putting aside, therefore, the merely commercial aspect of bee-keeping, there is still a wide field of interest and research open for exploration by the intelligent bee-keeper.

BEE-KEEPING FOR PROFIT

CHAPTER I

General Information and Hints

THE question of profit depends almost entirely upon the knowledge, energy, and perseverance of the bee-keeper, for, given suitable hive-accommodation and proper attention, the bees can generally be depended upon to do their share of the work.

Regularity and Foresight.—All who are engaged in productive work in conjunction with Nature know that "there is a time for everything," in connection with that work, and every advantage must be taken of that particular tide if full benefits are to be secured at the harvest season. Work must be done in regular rotation. A farmer must plough his land before he can sow his seed ; the seed must be sown at a certain time—sown in hope many months before the harvest can be expected. The same regularity and hopeful anticipation are necessary in

bee-keeping if full advantage is to be secured of the honey-harvest. In the same manner, just as farmers must make use of modern methods and appliances to obtain the best return for the outlay of capital and labour, so the bee-keeper must bring into his work the practice of up-to-date principles and labour-saving appliances connected with bee-keeping.

The old "skep," and the happy-go-lucky methods connected with it have given place to the frame hive with well-defined principles to govern and stimulate the production of its community of workers.

To work a bar-framed hive for profit it is first necessary that the bee-keeper should exercise forethought and be prepared for any emergency that may arise. He should always have by him plenty of spare frames, foundations, supers, and other necessities, for nothing is more annoying than a shortage of such during an unexpected honey-flow. It is always at such times that his orders take longest in fulfilment, for it is then the appliance-maker is overwhelmed with commissions from unprepared clients, and the delay in the delivery of the goods means a corresponding reduction of the bee-keeper's profits.

Watchfulness and Intelligence.—These two

qualities are essential assets to any would-be successful bee-keeper. There is no "golden rule," for his guidance through the year, nothing that must be done invariably at stated times and seasons. It is here that the novice is puzzled and perplexed, for apparently what is right at one time becomes wrong at another, but it is only by experience that the guiding knowledge is acquired. For instance, it is useless to feed a hive with the view to increase the brood, if the hive be queenless, or possesses a drone-breeding queen, or a fertile worker. And again, it is useless to put a super on a queenless stock or a weak hive, for instead of helping to conserve the heat of the hive one but adds to the area for the bees to heat with their own little bodies, with the additional risk of chilling the brood and starving the bees. For it should be remembered that the colder the hive, the greater the consumption of food by the bees.

It is well to bear in mind that the best of all heat-producers in a hive are the bees themselves, but to enable them satisfactorily to become so suitable accommodation and food are absolutely necessary.

The Queen.—One of the greatest mysteries connected with the hive is the life history of

the queen bee, and her position in the bee community. Each hive is, as it were, a republic of female workers, who serve with slavish devotion one of their number set apart from birth for the position of supreme head of the community. Like their sex generally throughout Nature, they give of their best where it is most needed. They know by their instinct that if the queen is fed with rich food her egg-laying capacity is stimulated, and, on the contrary, when the honey-flow is finished, that the supply of such food must be checked, with a consequent reduction in the number of eggs laid. They know that the greater the population of the hive the greater the drain on their honey store.

Generally speaking the life of a queen bee extends from two to five years, at which age she is generally exhausted, or is deposed by the community in favour of a younger queen.

The egg from which a queen bee develops is at the first precisely similar to that which produces a worker, and both are fertile. It all depends upon the kind of cell in which the egg is deposited by the queen whether a mere worker or a royal offspring ensues. The queen cells are acorn shaped, and larger in size than the others and are generally placed on

the edge of the comb. It is when the eggs are hatched—three days after they have been placed in the cells—that the special treatment of the queen grub commences. It is taken charge of by the nurses and fed with the rich food—known as "chyle" food (see page 50), and it is this food alone that produces the difference between a queen and a worker bee.

When the young queen is about a week old she will leave the hive to find a mate. As mating can only take place when the queen and drone are on the wing, she soars into the air followed by the rival and eager drones. When the mating is accomplished the queen returns to the hive and is then capable of laying eggs, both fertile and unfertile, at will. The drone also returns home, but only to die: he has laid down his life for the perpetuation of his race. A queen that has been recently mated can be identified by a white speck on the back near the end of the abdomen — the organ torn away from the drone.

Should a queen fail to be mated within six weeks of her leaving the cell she is only capable of laying unfertile eggs. The egg-laying capacity of the queen, under the "chyle-food" treatment is enormous, ranging up to 3,000 eggs per day.

When a ruling queen realises that a queen grub is being reared in the hive, the sex-hatred of a possible rival soon manifests itself, and were it not for the watchful care of the workers the young queen's career would soon be ended. But the old queen is put virtually under arrest, and not allowed to venture near the queen cells. Her agitation increases until she summons together all who are willing to follow her and leaves the hive. This exodus of a queen and her adherents is known as "a swarm." (See page 44.)

The queen bee can always be distinguished by her greater size, while the increased length of her legs makes her still more prominent among the workers. If it is wished to prevent the rearing of queens in the hive, all that is necessary is for the bee-keeper to cut out the queen cells from the combs, and give the bees additional room to store the food they gather.

The Worker Bee.—The normal worker bee is an undeveloped female and a true amazon. She is utterly indifferent to the drone, and is, of course, unable to propagate her species. In some cases, however, the ovaries of a worker are so far developed that she is able to produce eggs which are necessarily unfertile. Such a worker is a nuisance in a modern hive worked for profit.

As we have already seen, the egg from which the worker develops is precisely similar to that from which a queen springs; the rôle of worker or queen is determined by the cell in which the egg is deposited. A grub in a worker cell gets but little "chyle" food—it is stopped altogether on the third day—and a mixed diet of honey and pollen. The drone is brought up entirely on the latter food.

As soon as a worker grub leaves the cell it enters upon its life of labour. It is immature at this point, and as the air-organs, or tracheæ, are not fully developed, it cannot fly. Its first work, therefore, is that of "nurse" to the grubs still in the cells, and to supply the queen with "chyle" food. About a fortnight after leaving the cell, the young bee, if the weather be fine and warm, will venture out of the hive to try its wings, and on early spring days such numbers of them may be seen sporting near the entrance of the hive as to lead a novice to suppose that swarming was about to take place. The bee-keeper of experience, however, while rejoicing at the sight, will know that the exodus is partly due to the fact that some natural or artificial food has entered the hive and that more must be supplied for the needs of the inmates.

After the worker's trial flight, she proceeds upon her duties as a food supplier to the community. She has had some experience as a "nurse" in handling pollen, so that at first it seems but natural she should give most attention to that food, and, in cleaning her body from its clinging particles, she finds out the uses of her several organs. In the beginning her loads of pollen are often small, but with experience her carrying capacity soon finds its limit. In time she discovers nectar in the flowers, and as she becomes less able to gather pollen she increases her honey-collecting power. When nectar is abundant bees will often commence their work at sunrise and continue throughout the day until sunset. In such a "honey-flow" the average life of the worker from the time she leaves the cell is seldom more than six or eight weeks, every minute of which is given up to the communal labour. The whole of the work inside the hive depends upon the worker—she is architect, builder, caretaker, nurse, sanitary officer and the rest; there is method in everything she does, so it is inadvisable to interfere unnecessarily with any part of it. She objects strongly to undue interference, to mere curiosity of inquisitive humans. The worker bees are, indeed, wondrous creatures: they are known to

have their feelings of friendship and dislike almost human in their intensity; their expressions of sorrow on the loss of their queen or when their stores are failing are as unmistakable as their hum of contentment when the hive is thriving, or the buzz of anger when rudely disturbed.

The Drone.—The drone is the male bee. He is the progeny of an unfertilised egg laid by the queen, or by a fertile worker. His life is usually a short and merry one. He lives entirely on the labour of others, and, unless there is something radically wrong with the hive, he is seen only during the spring and summer months, when his services are in requisition. When on the wing the drone is by far the noisiest of bees, although the sound he makes is somewhat similar to that made by the worker when on the warpath, the note of warning to the disturbing human, and the trumpet call to her fellow-workers.

Owing to the peculiar structure of the drone, mating can only take place in the air, and when it has been accomplished the drone returns to the hive but to die. When the honey-flow fails the death warrant of the drones still in the hive is issued. They are seized by the workers and killed or ejected from the hive. To the

onlooker there is a certain amount of amusement to watch this slaughter of the non-producers of the community: to see a couple of workers wrestling with the unwieldy drone, perhaps biting off one of his wings in the effort to disable him, before the finishing stroke is given. When, however, a bee-keeper sees the array of dead drones he will probably think it would have been better for him had they been workers—producers rather than consumers of honey. It is, of course, greatly to the advantage of a bee-keeper that the number of the drones should be kept down as low as possible. This can be done by giving the bees full sheets of bees-wax impressed completely with the basal forms of the natural worker cells, thus inducing them to confine their building to those cells only.

We have already referred to the fact that a worker bee and a virgin queen are capable of producing eggs. The progeny of these eggs, however, although they may be produced in worker cells, are drones, fully developed, though smaller than those hatched in drone-cells. When this state of affairs is discovered in the hive the bee-keeper must ascertain by observation whether it is the queen's doings, and, if so, depose her and, if that of a fertile worker,

Worker Bee

Queen Bee

Drone Bee

(Magnified two diameters. Photographs by John J. Ward, F.E.S.)

destroy her. As a rule a fertile worker deposits her eggs in a scattered sort of way, but as the cells containing them are always capped as drone-cells—that is the cappings are raised in a dome-like way—they are easily distinguishable to the experienced eye.

Metamorphosis.—The metamorphosis, or change of form, which occurs in the early life history of the bee is among the most interesting in the insect world. When the egg is deposited by the queen, it rests on end on the bottom of the cell and almost parallel with the sides. At the close of the first day it inclines to an angle of about 45°, and after two days it falls to the floor of the cell. As a rule, the period of incubation is three days, and the grub is immediately taken charge of by the nurse bees, and fed according to the kind of cell in which it has been placed. At the end of five or six days the grub is sealed up in its cell to undergo the next, or pupa, stage of its existence. Generally speaking, the queen is ready to leave her cell on the fifteenth day, the worker on the twenty-first, and the drone on the twenty-fourth day from the time the egg is laid. If the weather is cold these periods may be extended: it is a curious fact that the egg of an insect can often bear a greater in-

tensity of cold without injury than can the developed insect.

Anatomy of the Bee.—It is advisable that all bee-keepers should know something of the structure of the bee, of its principal organs and their functions. The subject is too technical to be dealt with at length in a volume such as this, but the following notes may be of sufficient service to rouse interest to further inquiry.

Tracheæ.—Bees have no lungs, but in place of them have air-sacs, connected up by air-tubes or *tracheæ* which run throughout the body, varying in size much as do the "veins" of a leaf, until they are minute enough to serve the extremities of the insect, the antennæ and sting. This arrangement of the air-supplying organs, general throughout the insect world, may have something to do with the hibernation, to which most are subject in a greater or less degree, in cold weather.

The worker-bee is extremely sensitive to cold, but the queen seems far less susceptible, and often causes perceptible anxiety in a hive by wandering out of the cluster in cold weather. I know of one instance which came under my notice where the queen was very much alive in a hive in which all the workers were

dead, or dying from starvation in cold weather, and although it is a recognised fact that queens which have been injured by frost become drone-breeders it was not so in this case.

The Antennæ.—The antennæ of the bee must be accounted among the most marvellous of its organs. They are made up of a number of joints and chambers, and, though they are conjectured to be the organs of the senses of hearing, feeling, and smelling they are not definitely so known to be. As in the case of many other insects the antennæ of the male bee are much longer than those of the female.

The Tongue.—From the bee-keeper's point of view the tongue of the bee is one of its most important organs, for by means of it the bee secures the nectar from the flowers. When the nectar is in abundance the tongue serves as a trunk or proboscis through which it can be drawn, and when the supply is scanty the spoon-like end of the proboscis serves to lap it up. From the tongue the nectar passes into the "honey stomach" from which it is regurgitated and stored in the hive.

The Legs.—The six legs of the bee serve

for manifold purposes other than walking, and are so wonderfully adapted to them as to be worthy of close study. They serve as hands, as combs and brushes for cleansing purposes, they are provided with claws which are available for climbing rough surfaces, or for clinging in the swarm: between the claws is a pad which secretes a substance which enables the bee to walk comfortably on smooth surfaces whether upside down or normally. On the thighs of the hind legs are the pollen baskets in which are carried the burden of pollen gathered from the flowers and taken to the hive for storage.

The Eyes.—Three eyes, one simple and two compound, form the complement for each bee. The single eye, the smallest, is placed in the centre of the crown of the head, and the two compound on either side of the head. Each compound eye consists of hundreds of facets each of which has a perfect vision. Much argument has been made as to the reason for all this sight-power, but without arriving at any satisfactory conclusion. It is certain, however, that although the bee can move about freely and work in the darkness of the hive, *yet it cannot see in the dark*, for who among those who have worked bees has not heard the

plaintive wail of a bee that has been overtaken by the night before gaining its hive—and this with the hives within easy range?

The Jaws.—The jaws are used in much of the work of the hive—kneading wax, cutting and reducing the combs, capping the cells, for clearing away refuse, and particularly for carrying dead bees from the hive. They serve as weapons, too, for fighting, and in ejecting the useless drones when their season is ended. Then the jaws are used as nippers to cut the wings of the bulky drone and so render him helpless.

The Wings.—Each wing consists of two parts, an arrangement which allows the bee to close, or fold them up when she alights. On the adjoining edge of each part is a row of minute hooks, and when the wings are expanded these hooks become attached and thus provide a strong and reliable flying surface. In addition to providing the means of flight, the wings of the bee serve as fans for the ventilation of the hive, a certain number of the community, who also act as sentries, often being engaged in such duty. Should a bee-keeper see any of the "fanners" at work on the alighting board at the entrance of the hive he may know at once that the hive is

too warm, and if he be wise will open the entrance a little wider. Should the bees continue their ventilating work after that, then he may surely know that something is wrong and open the hive to investigate. The bees do not so work without urgent need. It may be that the stores of food are fermenting, or that wet has penetrated to the combs: mice may have entered the hive, or, worst of all, foul brood may be rampant. All these would cause bad odours, and the bees should be helped as speedily as possible to remove the evil.

The Sting.—This weapon of offence and defence is usually the last in the equipment of the bee to be used, for its discharge generally means loss of life to its owner. To the enemy against whom it is launched, it becomes a source of irritation and annoyance and sometimes of danger. The sting is a fine lance, with incisions down one side which act as barbs when the flesh is pierced by it, sinking the lance deeper at each convulsion of the stinger or the stung. So soon as a barb is fixed it is impossible for the bee to withdraw the sting, and in its struggle to be free the whole of the stinging organs—including the poison sac—are dragged from

it, and the poison enters the wound. For this reason it is necessary that the sting should be extracted as soon as possible, for the longer it remains in the flesh the greater will be the irritation. Should the sting be inflicted near a hive it will be wise to remove oneself from the neighbourhood without loss of time, for it is a well-known fact that the scent of the sting attracts other bees and arouses their anger against the presumed enemy of their kind.

The best remedy for a sting from a bee is methylated spirit, applied immediately the sting has been extracted—though it is well to remember that bees have an abhorrence of spirit, so that all trace of it should be removed before venturing near a hive, or further stings may be induced. There are many popular remedies for stings, such as the application of ammonia, washing soda, the blue bag, an onion—all of which have the same object—to nullify the effects of the irritant poison, of which formic acid is one of the principal constituents.

Occasionally bees will attack fowls, although it is more than likely in most such cases that the fowls are the aggressors and

mistake the bees for flies, of which they are very fond.

Stingless Bees.—There has been much talk of breeding stingless bees, but personally I do not think such bees are ever likely to oust our native breeds, for what chance could they have in fights with the armed variety?

CHAPTER II

Hives

THE question of the hive is, of course, the all-important one to the bee-keeper; upon it depends in very large measure the success or non-success of his enterprise. To the beginner, especially, it is a matter for serious consideration, one not to be dealt with in any haphazard fashion. There are so many forms and varieties of hive on the market to-day that the novice, who perhaps started out with the idea that a hive was merely "a hive—any one would do—and the bees would accomplish the rest," is puzzled as to how to make a selection. As a general recommendation in this direction I would say, *select the one that is least complicated and easiest to clean.* Simplicity in working, combined with efficiency in its purpose, is a sure and safe standard to apply when selecting a hive. It is as well for the beginner to try one or two varieties, so that he may find out by experience which is better suited to his particular district, and the most convenient to

manipulate. That settled, he can then adopt for general use the one best suited to his purpose.

The Skep Hive.—The skep hive, made of straw, is the survival of those pre-scientific days when bee-keeping was conducted without method, other than providing a house for the bees. Except that it is still used by some who will not take the trouble to adapt themselves to the modern methods, the skep hive would find no mention in a book on bee-keeping for profit. Primarily the skep was made by our forefathers merely as a means of securing the bees for the honey season, by providing them with a ready-made home in which they could prepare their combs and store their honey. Originally it was a rough structure of straw, bound together probably with bramble-runners, peeled and split, and it has developed into the form in which we know it to-day. Its picturesqueness in the cottage flower garden cannot be denied, neither can its utility up to a certain point, and that point was when the time of the ingathering of the honey harvest arrived, for to secure the honey the bees were destroyed. As a rule, it is the hive that contains the best queen which has the most honey, and as the skep that was

heaviest was always selected for clearing, it necessarily followed that in destroying the bees the best queens were sacrificed.

The usual plan of "taking" a skep hive was to dig a hole about a foot deep, not quite large enough to hold the skep. A few red hot cinders were placed on the bottom and on these was scattered brimstone. Then the skep was placed over the hole and the bees smothered by the sulphur fumes. It was a cruel and wasteful practice and it is strange that it should survive in these days when the knowledge of better and more economical methods is within reach of all.

Unless, however, disease is rampant in the district the "skepist" is oftentimes a benefactor to a neighbouring up-to-date apiarist by supplying him with swarms, or "driven" bees.

The capacity of a skep is sometimes increased by means of an "imp" made of straw of the same circumference as the base of the skep on which the hive is placed. Another method is to use bell glasses and sections as a "super" placed over the feed-hole of the hive.

Although it can find no place in profitable bee-keeping—unless it be for temporarily

hiving a swarm—the skep nevertheless possesses some advantages over the wooden hive. It is not liable to the attacks of fungus, or rot; it is also warmer for the bees in winter if properly covered in severe weather, for as the combs are fastened to the sides of the hive they serve the purpose of a cavity wall or dead space.

Wooden Hives.—The wooden hive now reigns supreme in all well-regulated apiaries, and the mechanical methods of working wood, with their accuracy of joining, &c., from a constructional point of view have brought them practically to perfection. It must be confessed, however, that wood is not the ideal material for hive making. As we have already suggested, it is subject to deterioration from fungus and rot, and, even when well-seasoned, contains a certain amount of moisture which renders it readily liable to these evils. The interior of a hive, too, becomes moist from condensation, which again helps to promote decay, a decay which in turn is favourable to the development of disease among the bees.

As a check to the ill-effects of this moisture some bee-keepers make a practice, when cleaning their hives, of thoroughly scorching the interior walls with a blow lamp.

So-called "rot preventers" are not to be recommended for use inside the hives, for many of them are highly injurious to the bees.

In purchasing hives it should be seen that they are in no wise cracked or warped, that no large knots are contained in the wood, and that the workmanship of the joints is in every way perfect. The roof needs to be completely rain-proof and the eaves should hang well over the sides so as to ensure the rain-water being carried away from the walls of the hive.

Size of Hive.—In the selection of a hive the size must depend upon the bee-keeper's own convenience, so that it is useless to lay down any hard-and-fast rule. Many apiarists have a regular system of moving their hives from district to district to meet the varying crops and honey sources, and it naturally follows that the less cumbersome the hive in their case the better. Personally I prefer a hive of about eighteen inches square, outside measurement. This may be accounted rather large for winter requirements, but it is always a simple matter to reduce the interior space with a dummy.

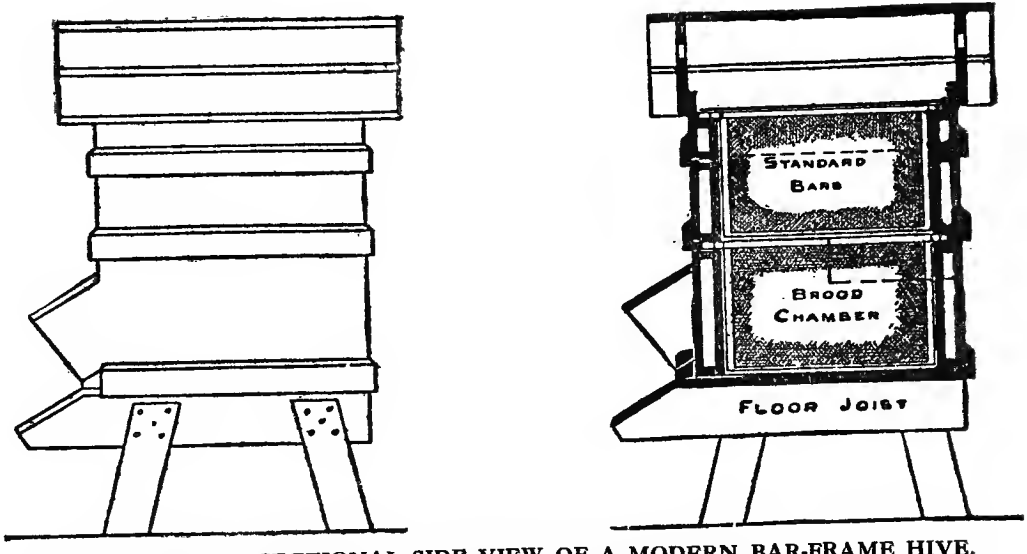
One or two odd sized hives are convenient to possess; they are useful in emergencies, and

the smaller sizes especially come in handy for queen rearing purposes, or when strengthening nucleus.

The Floorboard.—The hive bottom, or floorboard, which includes the sloping platform outside the hive, on which the bees alight, should be removable for the purposes of cleaning—which must be done thoroughly at least twice a year. This alighting board should provide for an entrance $\frac{1}{4}$ of an inch below the level of the sides and back of the hive and should slope upwards to the floorboard about 4 or 5 inches inside the hive.

When hives are moved frequently from one district to another it is advisable to have a short alighting board, as less space is thereby taken up in the removal conveyance. It is an easy matter to lengthen the board when the hive is in position if it is found necessary. A roofing slate makes a very good addition to a short alighting board.

The Brood Chamber.—The brood chamber rests on the floorboard: it is usually made with a porched entrance from the alighting board, but, although a porch is useful if the hive is in an exposed situation, the bees, as a rule, will do equally well without it. The porch, indeed, often proves a source of trouble to young bees,



SIDE VIEW AND SECTIONAL SIDE VIEW OF A MODERN BAR-FRAME HIVE.
(This Hive has a double set of Standard Frames)

who fail to find the entrance and rush frantically along the top of the porch in their efforts to do so. The brood chamber usually has two single and two double walls: on the inner, which are lower than the outer, rest the ends of the bar frames that contain the combs or brood foundation. It is here that the brood is reared and the natural life and work of the hive proceeds.

Bar Frames.—The bar frame is used as a case or support to hold the honeycombs. Without them it would be impossible to lift the combs from the hive and replace them in their proper position. It is these frames that enable the modern bee-keeper to do so much more than was possible with the old skep, and it has been by their aid that so much has been learned of the home-life of the bee.

Standard Frames.—Frames vary in size in different countries, but the standard frame now in general use in Great Britain is $8\frac{1}{2}$ inches high, 14 inches wide, with a top bar 17 inches in length. The $1\frac{1}{4}$ inches at each end rest on the top of the inner walls of the hive. The frames are spaced the proper distance apart by metal ends of uniform size. There are many varieties of these "self-spacers," but those most generally in use in England were the invention of a past-

master in apiary, the late Mr. W. B. Carr. These "ends" slip on the terminals of the top bar. When handling the frames, care should be taken not to hold them by the metal ends, as they are apt to slip off and cause disaster. Another matter that needs attention in connection with them is their liability to rust, and when working for honey production the bee-keeper should be scrupulously careful to see that only good clean metal ends are used on the frames.

To Hang Standard Bar Frames.—The sides of the frame should hang at *least* $\frac{3}{16}$ of an inch and at the *most* $\frac{1}{4}$ of an inch clear of the walls of the hive. If the space be less than $\frac{3}{16}$ the bees will fasten the combs to the sides of the hive, and if it be over $\frac{1}{4}$ of an inch they will build combs between the frame and the hive. The narrower space is sufficient to allow the bees a free passage round the frames.

Some frames on the market are a little wider than the ordinary standard. Known as "wide-shouldered frames," no "spacers" are necessary to keep them the proper distance apart.

Standard frames, however, can be used successfully either in the ordinary hive, the queen-rearing hive, or as a "super" (see page 31) if it is worked in accordance with the instructions

given on page 73, for as they are exactly the same in measurement they can be interchanged with any hive. It is advisable to pin or nail together any loose parts of frames when making them up, for by so doing regrettable accidents may often be avoided.

Shallow Frames.—The shallow frame is only 5½ inches high, with other dimensions similar to the standard. They are used by most bee-keepers in this country who work for surplus honey. They are of a convenient size for gathering and storing separately the various "crops" of honey. This, of course, is a great advantage, for it enables the bee-keeper to select the choicest honey for exhibition, or for sale at increased price. They are especially useful in this direction when heather honey is the objective, both as a body box and as a super. As a super, indeed, they are generally recommended to the novice in bee-keeping, as, owing to there being less space for the bees to heat, they are warmer than the standard frames for this purpose. There is no question that a warm super induces the bees to explore it, and if food is plentiful to use it as a store or warehouse, while, on the contrary, should the heat of the super be lowered by a change in the outside temperature after the bees have commenced to

store therein, they will often remove the honey thence to the brood-chamber.

Shallow frames are also used by some bee-keepers when working for sections in strong hives immediately over the brood-chamber, as this procedure usually prevents the lower case of sections from becoming discoloured by the heat from the brood.

Sections.—Sections are small wooden frames, which in England are generally about $4\frac{1}{2}$ inches square, in which honey may be stored by the bees ready for sale purposes. They are made from the wood of the American lime tree—commonly known as "basswood"—which is beautifully white and easy to "work." The sections are made all in one piece, which is cut into shape by machinery. The sections are placed in a rack or "crate" which usually hold twenty-one in seven rows of three, with a divider of tin or wood between each row, and a "bee space" under each section.

The method of working with sections is explained on page 94.

The Super.—The super, or lift, is the bee-keeper's addition to the hive, in which he induces the bees to store honey for him. It is placed above the brood nest and supplied with frames or sections in which the bees may work *apart*

from the brood. To secure that, of course, is the duty of the bee-keeper, and in the chapter following, the method will be dealt with.

Bee Escapes.—The "escape" is to provide the bees with an additional exit from the hive or super. It is fixed in a hole bored through each end or side of the top portion of the hive, two or three inches below the centre of the roof. The old-fashioned cone-shaped variety is now usually worked double, one being fixed inside the hive and one on the outside, but they are not altogether satisfactory, as the bees will sometimes find their way back through them to the super. It will also often be found when clearing supers by this means that the bees are very slow in escaping. A new escape, called "The Porter Escape," with a spring has been recently invented which allows the bees to return from the super direct into the hive. It is fixed on a board which is placed under the super.

The Dummy.—The dummy is a piece of board with lugs or ends which project from the sides, and rest on the inner walls of the hive. It is, in fact, a movable wall which is used to reduce the capacity of a hive. The requisite number of frames are removed and the dummy placed in position to cover the exposed side.

The Quilt.—Over all, is placed the quilt

which retains the heat in the hive. Most bee-keepers have their own opinion as to the best material to use for this purpose. American cloth, glass, wood, carpet, horse-hair, matting, felt, sacking, cotton, and paper all find their advocates, and probably experience has proved them all. It is useless, then, to be dogmatic in favour of any. I would suggest, however, that one of the cheapest forms of quilt is one made of unbleached calico, for this is about the only material that the bees do not try to sample, or fasten to the frames.

Generally speaking it is advisable that a hole should be made in the quilt for feeding purposes. For this it is not necessary to cut a piece quite out but merely to make an incision along three sides of a square, thus forming a flap that can be folded back when feeding is necessary. This quilt should, of course, be supplemented with others to secure thorough retention of heat in the hive.

All old quilts that have any "propolis" (see page 51) on them should be saved to pack round crates of sections, or the propolis may be cut off and used as a decoy in spring amongst artificial pollen.

Queen-Rearing Hives.—There are many varieties of "nucleus" or queen-rearing hives,

but the one I have found to give most satisfaction holds from three to five standard frames. These are used solely for the purpose of rearing young queens to take the place of those worn out by hard work or old age. The method to be followed in this direction is given on page 75.

Observation Hive.—This consists of a glass case made to hold one standard frame, a shallow frame, and a row of sections. The bees can thus be seen at work on the combs. It is mounted on a pivot, through which the bees must pass to the entrance. Of course, the "observation hive" is not intended to keep bees in for more than a few days at a time, and when it is in use care should be taken not to expose the combs or the bees to the heat of the sun.

CHAPTER III

Bee-keepers' Requisites

Comb Foundation.—It is this wonderful invention that with the bar-frame has made bee-keeping a practical factor; without it, indeed, the bar-frame hive would be useless from a commercial point of view. The "comb-foundation" is a thin sheet of bees-wax, impressed by machinery, on both sides, with true hexagonal, or six-sided, bases of cells, a slight foundation for the walls being also impressed. Thus the bees are given a start, as it were, in their work. This foundation is made either with "worker" or "drone" cells and the bees will follow unfailingly the lead thus given them in their building. It is made in three degrees of thickness—"thin," "medium," and "thick"; the first for use in sections, and the others in the brood chamber.

As a rule bee-keepers in England buy only the worker-brood foundation, for should drones be required they can be secured by merely cutting away the lower part of a honey-comb,

or supplying only half a sheet of foundation in the frames, for the bees will almost without fail build drone cells on these.

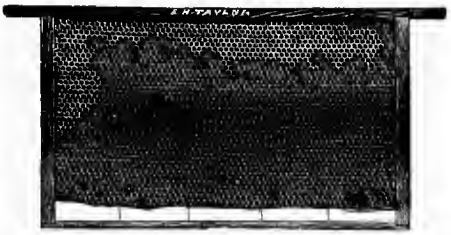
Foundation is catalogued by all makers of bee-keeping appliances, but it should be obtained only from reliable sources, for one of its essentials is that it should be made from pure bees-wax thoroughly cleansed and sterilized. Otherwise it may contain germs of brood disease.

Old Foundation.—If a stock of foundation should at any time be left in hand it is advisable that it should be slightly warmed before it is given for the use of the bees, for unless it is quite pliable the bees will reject it.

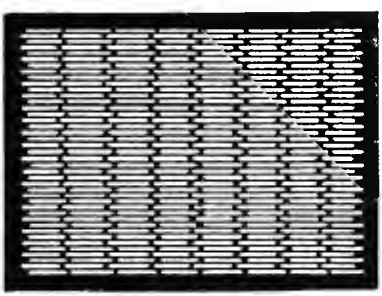
Excluder Zinc.—It is impossible to work the bar-frame hive for profit without the aid of excluder zinc, for it is this useful appliance which prevents the queen from entering the supers and spoiling the surplus honey by laying her eggs in the comb. For the novice must learn at once that no honey should be extracted from combs which contain brood.

The queen excluder should completely cover the open space above the brood nest before the super is placed over it.

A new queen excluder is now on the market, made of hard wires strapped together, and



A Standard Frame with Drawn-out Comb



An Efficient Queen Excluder

A Frame Hive with the top removed

the patentee claims that more workers can pass through it than is possible with the old type.

Feeders.—There are many varieties of feeders in use among bee-keepers, and to attempt to give a description of them all would occupy far too much space. It would, moreover, be unnecessary, for, after all, the method of feeding is one to be decided by the bee-keeper's own convenience and resources. Several feeders are on the market to meet the requirements of quick feeding; these are made either of tin or wood and include the "float feeders" and the Canadian pattern, both of which find considerable favour. Another type covers the so-called "slow feeders," in which the supply can be regulated by turning the food vessel round to allow a larger or smaller quantity of food to escape at the option of the bee-keeper.

A cheap and serviceable feeder may be made by filling a glass jam jar or pickle bottle with syrup and stretching a piece of bleached calico over the top and tying it securely round the neck. The jar is then placed in an inverted position over the feed-hole of the hive. Should the syrup escape too quickly another thickness of calico can be added. Glass jars

should always be used as inverted feeders as the quantity and condition of the remaining food can be seen at a glance.

Scrupulous cleanliness is necessary with all feeders, or the food is liable to turn sour or ferment.

Uncapping Knives.—Used for the purpose of removing the cap of wax from the cells when extracting the honey from the combs, these knives should be made of good material and be kept perfectly clean and bright. Blades which discolour quickly should not be used, and where large quantities of honey are extracted at a time it is advisable that two knives should be available. This enables the process to be continuous, as one knife can be heated—in hot water—while the other is in use.

In using the knife it is better to give it a sawing motion when uncapping, for by so doing the chances of injuring the cells are considerably lessened. It should be so arranged that the cappings fall, as they are removed, into a tray or dish.

The Extractor.—This is a machine which should be included in the outfit of every bee-keeper who is working with a view to profit. The initial outlay may seem large, but by its

quickness and efficiency a good machine soon pays for itself and contributes to the credit side of the account. The extractor is usually cylindrical in shape and contains two cages, each sufficiently large to hold one standard frame of comb. These cages are attached to a spindle which runs through the centre of the machine, and is worked either direct by a handle or by a simple chain or cog gear at the top. A lid and a honey tap complete the outfit. The advantages of the extractor are many, but the chief one is that the honey can be separated from the combs without breaking the latter.

Hints for working the extractor are given on page 98.

The Honey Press.—This is used to squeeze thick or dense honey from the combs. There are many varieties and makes on the market, ranging in size down to that of the ordinary potato squeezer. Those used by the larger honey farmers work with screw pressure. The combs are placed in a wrapping of cheese-cloth, laid between pieces of American wire which rest on fluted or ribbed boards, and the pressure applied. The honey escapes by means of the fluted guides and the wax remains as a solid cake.

The Smoker.—This is an indispensable

article in the equipment of the bee-keeper. It is not intended for the purpose of stifling the bees, but on the contrary to make them good-humoured, and, although it does not always have the desired effect, most bee-keepers have often proved the smoker a good friend. The effect of the smoker when properly applied is to cause the bees to gorge themselves with honey, for bees, like most human beings, are good-tempered after a hearty meal.

After the smoker has once been lighted it should be placed on end, for should it be laid flat the fuel will probably be extinguished.

It is always advisable when working the smoker to have a spare cartridge handy so as to replace the one immediately it is consumed.

Fuel for the smoker can be made from thin corrugated strawboard, brown paper, calico, cotton wool, or anything indeed that will smoulder rather than burn with a flare. It is a good plan to roll together some fast and slow burning materials, thereby ensuring a steady smother while it lasts. A supply of "cartridges" of this kind should be cut and tied into lengths ready for use when required.

Carbolic Cloths.—These are useful for driving the bees down from the frames into the hive, when the frames need manipulating. The

cloths are usually about 18 inches square, made of calico, and sprinkled with one part of carbolic acid to two parts of water. They are laid over the tops of the frame, but care has to be taken that the carbolic solution is not too strong, or the bees will be driven from the hive.

When not in use, the cloths should be kept rolled up in a tin to ensure their cleanliness and to retain their strength.

Brushes.—Bees are very particular concerning the kind of brushes used by the bee-keeper to brush them from the combs, or to gather a swarm together when it is scattered under a bush or in a position where it is not possible to shake them into a hive. They have a firm objection to anything of a hairy nature, and the very best method to rouse them to wrath is to use a housemaid's broom under the circumstances mentioned. It is a certain incitement to trouble.

Most brushes sold by appliance makers are of fibre, but one of the very best forms can be made from montbretia leaves. The leaves, or blades, should be cut from the plant near the ground and the tops doubled over and tied near the end of the stalk. The stalk end is used as a handle, the "brush" consisting of the intervening part. Montbretia is a

very adaptable plant and will thrive almost anywhere with a little care.

Disinfectants.—Disinfectants play a large part in the work of the bee-keeper, to secure the cleanliness which is such an essential factor to success, for the prevention of disease, and the confounding of the many enemies of the bees.

Carbolic Acid is the disinfectant most generally used, probably because it is available for other purposes. It should not be used, however, when supers are being removed or on any combs containing honey that is to be taken for use. When cleaning the inside of a hive only one part of carbolic acid should be used to ten or even twenty parts of hot water, and care must be taken that the hive is thoroughly dry before combs are placed in it, or the bees admitted.

Naphthaline and *Camphor* are each used for disinfecting purposes, but more especially as antidotes against the wax-moth and other insects that play havoc in the hive. Two fairly large pieces can be placed in one hive, either in the cavities at the ends of the frames or over the quilt.

Veils. — Some bee-keepers scoff at the necessity for a veil for protection when handling

the bees, but there is no question that in spite of the grotesque appearance it imparts the veil is "a very present help in trouble" to the average bee-keeper. Some people are fortunate enough to be sting-proof and such can afford to smile at those who seek protection from a veil, but to those who are not immune from the consequences of the angry attentions of the bee the veil is indispensable. Serviceable veils can be made of Brussels or silk net, mosquito netting, or fine wire. They can be procured in any colour, though black is most generally adopted, that having been found the least objectionable to the bees, who entertain violent prejudices on the subject of colour.

Personally, I believe that it is the human breath to which the bees particularly object, and I have found that if a little honey be eaten before one opens a hive the enmity of the bees will be neutralised to a very great extent.

A pair of gloves, with gauntlets, are absolutely necessary to the bee-keeper's equipment, though an admirable makeshift for the latter can be adapted from old stocking legs. These pulled over the sleeves of the coat, after the gloves have been buttoned, form an efficient guard against an exploring bee.

CHAPTER IV

Bees: Their Habits and Products

Swarming.—As already explained (pp. 7, 8) a hive will "swarm" when an old queen finds that other queens are being nurtured in the hive. In such a case she calls forth as many of her adherents as will follow her and goes out to found a new community. Oftentimes the site of the new home is definitely settled beforehand in some unoccupied hive, and in such cases scout workers will have prepared and cleansed the hive some days in advance. The passing to and fro of these pioneers will sometimes give the owner of the empty hive the idea that he has bees working there. Generally, however, the swarm issues from the hive without any definite objective and flies on until the queen settles, when her retinue of workers form a cluster around her.

As a rule it is an easy matter to tell when the bees are swarming, for they rush pell-mell in a tumultuous stream from the hive, and fly round and round, and in and out, hundreds

being on the wing together, taking the appearance of a living cloud. They are perfectly docile and will allow the spectator to stand among them provided they are not provoked. Of course this is easily done: the mere getting entangled in the hair of the onlooker is sufficient to rouse their anger. Any symptoms of nervousness, too, seem to become apparent at once to the bees, and perspiration, again, is objectionable to them. But an expert bee-handler may lift a swarm with his hands and suffer no ill, for so long as they are not crushed the bees will not resent the handling.

It is seldom that a first swarm issues from the hive other than when the weather is warm and the sun shining. Generally it is between 9 a.m. and 4 p.m. that swarming takes place. First swarms are usually the largest, for when the joyful hum of the rising swarm sounds forth many of the bees from adjoining hives will be drawn to join the swarm and are received in a friendly manner.

Virgin Swarms.—The bees of a swarm will often follow a virgin queen when she goes out to seek a mate, the bees apparently thinking that if she is lost they will die. It is therefore advisable that a hive which is known to contain a virgin swarm should have the

entrance blocked up so that only one or two bees can pass in or out at a time. This may be widened after the queen has been mated.

The Treatment of Swarms will be found explained on page 68.

The Scent of the Bee.—Every novice in bee-keeping should make a point of acquiring knowledge by practical experience on this wonderful point in connection with bees, for it plays a most important part in the success of bee-keeping. Not only does each hive diffuse a different scent from that of its neighbour—even though the nectar may be gathered by the bees from the same scource—but the scent of each hive may vary according to the work that is going on within it. Each individual bee, too, can diffuse a varying scent to suit its circumstances. An expert bee-keeper can generally tell from the scent immediately he opens his hive what reception he is likely to meet with, for even our native bees are seldom found to be docile in the midst or towards the end of a honey-flow.

When bees are swarming they emit quite a distinct scent, which probably accounts for the friendly reception accorded at that time to bees from other hives. When a stranger approaches a hive, or if the bees are disturbed,

it will be noticed that those on the alighting board elevate their abdomens and fan vigorously with their wings—with the result that other members of the hive rush to the scene. It is true that the sound of their wing movements is different from that caused by the ventilating fanning, but there is no question that an alarm scent is emitted from the abdomen and diffused by the vigorous movement of the wings. In the same manner the sting of the bee when discharged emits a peculiar scent which has the effect of rousing other bees to anger, as though to avenge the death of their fellow-worker. The expert bee-keeper well knows the scent of the sting even though he may be immune from its effect. It is well to note, by the way, that cross-bred bees as a rule are very quarrelsome and extremely sensitive, and are often dangerous on this account, for they are very free with their sting.

It seems evident that when a bee is frightened she loses her distinctive scent, for driven bees, when they have nothing to fight for, will unite peacefully. And I have known bees of the same hive fight among themselves in a moment of panic, thus affording evidence that the scent of the community has been

destroyed for the time, precluding the members of it from recognising their fellows under the stress of the fright.

The scent of the queen is different from that of the workers. This can be noticed especially in the case of a swarm, for workers will often be seen "retrieving" the place over which the queen has passed, even though the trail may be broken: should they fail to find her they will often cluster and die. Because of this it is never advisable to handle a queen, for the bees will notice the change of scent caused thereby and often will kill a queen they do not own; to stranger drones, however, they raise no objection during a honey-flow.

Honey—It should be clearly understood that, contrary to the assertion of the poet, bees do *not* "gather honey all the day, from every opening flower." Honey is essentially a product of the bee from the nectar provided by the flowers as an inducement to the visitation of bees and other insects—not for the benefit of the bee but to serve the purposes of the flowers themselves of cross-fertilisation. (See Chapter on "Flowers and Bees," page 53.) The nectar is assimilated by the bee and regurgitated in the form of honey.

Honeycomb.—The honeycomb is doubtless

Queen on a patch of Sealed Honey

(This is a diseased frame : notice the irregularity)

one of the greatest marvels of the bee community. In its architecture and workmanship it forms, indeed, one of the greatest wonders in the whole realm of nature. With its multitudinous hexagonal cells, a honeycomb presents a continuous source of delight; it is so constructed that not a single atom of space is wasted and so designed that the minimum of material is used. Let it be remembered that the honeycomb, primarily, is intended to serve as a nest for the offspring of the queen—each cell to be a separate cradle for the product of the egg placed therein.

As a rule, as we have noted, the cells are six-sided; the exceptions are the queen cells—which are acorn-shaped—and the intermediate cells which form buffers as it were between the worker and drone cells. The latter are always built on the outside edge of the combs. The worker cells are the smallest, and, although the bees hatched from new combs are usually larger than those from old ones, the difference is but slight. The reason for this is that as each bee is hatched it leaves behind in the cell the cocoon in which its metamorphosis was accomplished, and thus diminishes to that extent the size of the cell.

Bees-wax.—The wax of which the cells

are composed is produced from the body of the bee itself. It forms in thin plates underneath the abdomen, these plates being kneaded by the jaws into the required consistency and form. When comb-making is in progress the bees cluster together in festoons, very similar in appearance to a swarm. It is, of course, an exceedingly slow process, and the modern bee-keeper, to expedite matters in this direction, assists the bees by giving them ready-made foundation on which to build their cells. Fortunately the bees have proved amenable to this "hustling" process and are thus able to devote a larger part of their short life to the more remunerative work—from the bee-keeper's point of view—of honey-producing.

Chyle Food.—As before stated, this is the rich substance with which the queen is fed, and the worker grub indulged in for a short period. It is regurgitated from the chyle or second stomach of the young or nurse bees. All authorities agree that the power to produce the food gradually diminishes after the insect is a fortnight old. It follows, then, either that the young bees have the power to withhold the supply during a period of rest, or the power to assimilate it is acquired by the older bees, in proportion to their age and the ordinary food

they consume, during the period of compulsory retirement in winter. This semi-hibernation period varies in length in different parts of the country, but in some cases it must last for at least three months, between the date when the last eggs were laid and that when the queen resumes egg-laying again in earnest. Chyle food has a thick, milky-white appearance, an acid flavour, and quickly congeals if exposed to the air. Probably on account of its being fed to the infant bees one of its popular names is "pap" and another "bee's-milk."

Propolis.—This is a substance produced by the bees from the gum which exudes from buds and trees, or the wax given off by some grasses. Propolis emits a wholesome smell and is usually bitter to the taste. It is used by the bees to plug up any holes or cracks in the walls of the hive and to fasten the supers, lifts, frames, and sections together, and also forms their natural disinfectant. Although methylated spirit is violently disliked by bees, yet some forms of spirit varnish are very attractive to them, probably yielding something towards the production of propolis.

Some bees produce propolis to excess and it then becomes a nuisance, for hives in which such a condition exists are always more difficult

to work. The queens from these hives should never be used for rearing purposes. It will be found that foreign bees as a rule produce more propolis than the native breeds. Propolis always serves to attract bees, especially after it has been warmed before a fire for a few minutes; it then becomes very sticky. It is often used to entice bees to artificial food in early spring to stimulate brood-rearing before natural pollen becomes abundant. This is done by scattering artificial pollen among shavings or chaff, and generally serves its purpose.

Old quilts plastered with propolis are used by unscrupulous bee-keepers to attract swarms from neighbouring hives.

CHAPTER V

Flowers and Bees

In the economy of the world of flowers the bee plays an important part, while in return the flowers provide the wherewithal of existence for the bee. For the mere transference of pollen from one flower to another the plant offers the bee a supply of nectar and a percentage of the pollen which she is to carry for the plant's benefit. It is the case that most plants depend upon cross-fertilization, and while some rely upon the wind to carry the pollen, others, and by far the greater number, depend upon bees and other insects to perform the work for them. The methods adopted by flowers to secure the visitation of their insect friends form a fascinating study which cannot be entered upon here, ours only to consider the outcome, so far as the bees are concerned, of the transaction

Honey.—For the production of honey there must be for the bees easily available

access to nectar producing flowers, and it might be noted that flowers always produce most nectar when growing under natural conditions. It is a common error to suppose that all sweet-scented flowers are visited by bees; for in the gardens, roses and sweet peas are neglected by them, and in the hedgerows the honeysuckle is passed by—it caters for moths only, while, on the other hand, plants whose scent is entirely repugnant to the human sense of smell provide attractive and happy hunting grounds for the bee.

After the resting time of both flowers and bees through the dark days of winter there is a steady rotation of flowers through spring and summer, which is brought to a close in the autumn by the flowering of the heather. Approximately the appearance of the flowers of plants and trees is in the following order: snowdrops, winter aconite, early crocuses, "palm" willow, flowering currant, arabis, aubrietias, Norway maple, elm, plum, cherry, apple, pear, chestnut, sycamore, dandelion, the berry trees, whitethorn, and lilac; these mark the interval between winter and the full glory of summer's bloom. The bees will begin their labours almost as soon as the flowers begin to show, and all through the full

spring and summer their work never ceases. In August the heather gives them a busy time until the autumn brings the resting season round again.

Generally speaking the source from which honey is gathered may be recognised by its colour and flavour. Many flowers, indeed, exude nectar of a similar colour to their own, although it must be remembered that the honey always becomes lighter as it candies or granulates. But, approximately speaking, it may be taken that white clover honey should be very light in colour; sainfoin honey should be yellow, lime a greenish yellow, while heather honey will vary from orange to purplish red.

The flavour of honey varies in like manner, though it is an undoubted fact that the weather at the time of its gathering and storing by the bees influences it greatly. The warmer and sunnier the day the more pronounced the flavour of the honey.

White clover honey is esteemed the best for table and exhibition purposes, for its purity of colour, fineness of grain, and mild flavour. At the other extreme is heather honey—dark in colour, strong in flavour, and a texture so thick that it will not "run"; so thick, indeed,

that it is impossible to extract or strain it by the ordinary methods. As a rule it is usually pressed from the combs.

Pollen.—The bee uses pollen for a variety of purposes—for feeding the pupæ, as food for the older bees when honey is scarce or the stores diminishing, and for mixing with wax to seal the brood cells. "Bee-bread" is therefore a good name for it, although primarily its purpose is not to serve the bees at all.

Of an infinite variety of colour and flavour—each flower produces its own variety in both particulars—the pollen gathered by the bees is stored in the hive strictly with its own kind. It has been found that a bee visiting, say, clover, does not touch another kind of flower on that "round," and so on. And each section of the workers store their particular pollen in particular cells.

The young worker bee is usually well covered with hairs which serve to gather up the pollen from the flowers visited. Leaving a flower powdered over with it she scrapes it from her body into the pollen baskets on the thighs of her hind pair of legs. Discharged at the hive, the pollen is kneaded by the jaws and head and stored in the cells, where

it is covered with honey to preserve it. As the bee gets older the body-hairs are gradually worn away so that as time passes the worker becomes a honey-gatherer almost entirely.

CHAPTER VI

Hints on Working the Bees

Position of Hives.—All hives, if possible, should be arranged to face south, for cold and draughts are among the deadliest foes of the bees. Cold showers of rain or sleet in the spring often work havoc among them so that it is well to minimise the danger as much as possible. In this connection it is a common sight in early spring to see bees that have become chilled lying on the ground near the hives, and novices may gain experience in handling bees by picking up these moribund specimens. They should be lifted with one finger and thumb and dropped into a jar which should be covered at the top and placed before a fire. When the bees have revived they may be liberated.

Manipulating the Bees.—Confidence is the most necessary quality to the bee-keeper and one, of course, that can only be acquired by experience. One golden rule to be remembered by the beginner is that *the hive should be approached always from the rear,* and another,

that everything should be done slowly and deliberately and never jerkily. Nothing irritates bees more than erratic or jerky movements on the part of those manipulating the hives.

Until one has definitely proved immunity from the bee-sting it is necessary that all safeguards should be adopted before any work is attempted on hives of which the bees are in possession. The veil, gloves, and gauntlets should be donned and the trousers tied tightly round the ankles to prevent the incursion in that direction of any roving member of the hive. For although bees are usually on good terms with their owner they are subject to varying moods, and it is well to run no unnecessary risks.

The Smoker.—The smoker should always be ready to hand, charged and lighted, with matches immediately available in case the fuel does not burn properly. As already explained, the effect of the smoker is to cause the bees to gorge themselves with food and so become good-tempered. Having removed the roof of the hive, one corner of the quilt is raised and a little smoke blown under it. The operation should be repeated in two or three different places, and then an interval of two or three

minutes allowed to elapse in which the bees may fill themselves. The quilt may then be carefully removed, and if necessary more smoke may be blown over the frames, *but not downwards among the bees.*

When handling the frames the nearest one at the side or back of the hive should be taken out first, the bees that are on it shaken off, and the frame placed safely on one side. This allows ample space in the hive for moving the frames about for examination and other purposes without crushing the bees.

How to Handle Frames.—Frames should never be held by the metal ends, for these are liable to slip off and cause disaster. The frames should always be lifted and handled near the ends of the top bar.

A frame of comb should never be turned horizontally, for in that position the comb is apt to break. The proper way is to lower one end of the frame until it is in a perpendicular position, then swing it round half a turn and lower the other end. The comb will then be the wrong side up and the movement must be continued until the comb is again in its proper position.

Examination or other work in connection with the hive should be completed as quickly as

possible so that the combs may not be unduly exposed.

Spring and Autumn Cleaning.—In the springtime—generally speaking about the middle of April—it is necessary that the hive should be cleaned, and, to secure "a thorough spring clean," the bees should be transferred to another hive that has been already cleaned. If this is not done, the hive must be thoroughly overhauled, and should any of the combs be found to be in a bad condition and without any bees on them they should be removed. If the combs are full of brood and honey it is necessary to expand the brood chamber as described on page 67. In the autumn the hive must be examined and cleaned again. All empty combs, or those not used by the bees, should be removed and the space thus rendered vacant closed by a dummy. Should the hive contain only a small quantity of food the bees will have to be fed artificially. (See page 82.)

Weak Hives.—It is at the spring and autumn examinations that the real state of the hive community is discovered, and in the former the "weak" hive is a common occurrence. It is then that much depends upon the bee-keeper whether his work is to be successful or not. It is then that weak stocks must be brought up

and strengthened either by doubling or uniting the stocks, or by feeding.

The bees from strong hives soon find out those that are weak, and apparently act on the principle that "to him that hath shall be given," for they proceed to help themselves to the depleted stores of the weak hive. They even go to the length of forcing its occupants to help in the removal of their stores and grant them the privilege of joining their community for so doing. Those that remain faithful to the queen of the weak hive are thus reduced to starvation. When a bee-keeper finds that a weak hive is being raided in this manner he should close it up entirely for a day or two. This will often quicken the spirit of its inhabitants and cause them to retaliate on the raiders.

Doubling Stocks. — For this purpose an empty hive is necessary, and it should be one in which the frames range from the front to the back. Placing the two weak hives on either side of the empty one, the frame with the bees from the right hand hive are transferred to the right side of the new hive. A dummy is then placed and all holes through which a bee might crawl carefully blocked up. The frames from the other hive are then placed in

the remaining space and the hive closed up. Care should be taken to fasten the quilt down firmly so that the bees cannot obtain access to each other, for if they do they will surely fight. For the same reason the entrances to the two parts of the hive should be placed as far apart as possible and a piece of wood placed along the centre of the floorboard.

After a few weeks the bees in the two divisions will acquire the same scent and can be united. Should a spare queen be required one can be removed, if not the older one should be killed, for the bees should not be left to adjust the matter for themselves. A hole may be made in the dummy so that the bees can pass from one division to the other, and a few days after the dummy may be removed altogether.

This procedure may be followed also in the autumn, especially if young queens are numerous and it is desired to save some.

Feeding Weak Stocks.—If facilities are not to hand for thus dealing with weak stocks, the frames not required by the bees should be removed from the hive, the space contracted by a dummy, and the bees fed inside the hive. In the autumn it is advisable to give weak hives frames of food that have been

stored and sealed by a strong hive that is kept especially for such a purpose.

Whenever inside feeding is adopted, the entrance aperture to the hive should be reduced so as to keep out bodies of raiders. The most efficient means of securing this is to place along the entrance a piece of perforated zinc with holes just large enough for one bee to pass through at a time. This prevents a rush of marauders and allows ample ventilation in the hive.

Uniting Stocks.—This procedure is not so common among English bee-keepers as it is with those in other parts of the world where the conditions are more favourable to a successful result. The reasons are chiefly because we can very seldom secure that the bees all work on the same flowers, and because most of our English bees are cross-breeds and therefore more addicted to fighting. It is not to be expected that a broken breed of bees will unite peacefully with a pure breed.

However, uniting is sometimes resorted to, and the method of procedure generally adopted in England is as follows. The hives to be united are brought nearer to each other gradually, not more than a yard or so at a time, and on fine days only, when the bees are

Examining Frames

flying about. The need for this precautionary care is that the bees soon lose their bearings if their hive is shifted to any great extent and will fly about until death ensues from exhaustion; while to enter a strange hive in mistake for their own is equally fatal for them. The actual process of uniting is accomplished by taking combs alternately from each hive and placing them in their new quarters, meanwhile spraying bees and combs with scented syrup, or dredging them with flour.

I should, however, recommend the novice to "shake" or "drive" (see pp. 74, 79) each stock before uniting them, for hunger will do more to reconcile the bees to each other than anything else. The driven bees should be passed through a queen-excluder and the oldest queen, or queens, destroyed. This will save a battle royal in the new hive, and do much towards uniting the two sections of bees.

Queen-rearing hives may have frames of young bees added to them without much fear of trouble, for as a rule young bees do not fight.

Stimulating.—Bee-keepers who are working for honey generally stimulate the bees after the semi-hibernation days of winter are passed, for a period of some six or eight weeks before their services are likely to be required for honey

gathering. This is to encourage brood-rearing and is accomplished by feeding the bees with syrup or artificial pollen. (See Chapter on Feeding, p. 82.)

It must be remembered that once artificial feeding for this purpose has been resorted to it must be continued until the natural sources of nectar are available to the bees, for nothing checks the population or does more harm to the hive than stopping the food supply when breeding has commenced.

It should be the aim of every bee-keeper to make himself acquainted with the order and approximate times of blossoming of the flowers and trees, and particularly the largest source of nectar in his neighbourhood.

As a rule, from six to eight weeks is required to get the hives into a profitable condition after brood-rearing has commenced in earnest. In some favoured places the queen may begin to deposit eggs as early as January, though of course, in the north and colder districts, this is exceptional. Unless, therefore, a bee-keeper is in an exceptionally good district, and works for early fruit blossoms as a source of nectar, it is to his interest to leave the bees to themselves until the middle or end of March, provided, of course, they are not short of food.

Choked Brood-Nest. — When feeding the bees in spring it is necessary to spread the brood-nest from time to time by adding a frame of comb near the centre of it. This provides the queen with sufficient cells in which to lay her eggs. Should the brood-nest become choked with honey, feeding should be stopped and a frame or two of honey taken from the hive and extracted, or given to hives that are not so fortunately placed, filling up the space with empty combs. Should the stores of honey and pollen be plentiful, it is well to scratch the cappings from some of the cells, though care must be taken not to damage the cappings of the brood cells, which will usually be found in the centre of the frames.

Should the hive be full of frames and bees and most of the cells along the top of the combs be covered with clean white cappings, a super may be introduced, the necessary sheet of queen-excluder being placed over the brood-nest. The super should be a warm one with no leaky joints and fit properly over the brood-chamber. In districts exposed to high winds the precaution should be taken of tacking a narrow strip of thin soft felt round the bottom edges of the super to make it perfectly draught proof.

CHAPTER VII

Hints on Working the Bees—(*Cont.*)

Swarming.—One of the oldest practices associated with bee-keeping is that of "ringing the swarm." Immediately the swarm was seen to issue from the hive the bee-keeper began to create as loud a din as he could by beating a tin or tray, and, so doing, followed the bees in their flight. This entitled him to claim the swarm wherever they settled, even though it might be in a neighbour's hive. "Ringing" is still continued, for it is the most effectual means at command for causing the bees to settle. The explosion of firearms, a clap of thunder, or the roar of a blast, will secure their doing so, and probably the most effectual "settler" for a swarm is a shower of rain—but none of these is at the immediate command of the bee-keeper.

When, therefore, the swarm is seen issuing from the hive preparations should be made for "ringing" and following it. The noise should not be commenced until it is certain

"Skepping" a Swarm

that the queen has come out, or she may show no inclination to do so. Sometimes the swarm will fly for some distance, or it may happen to "cluster" comparatively near its former home. In some cases trouble arises from the fact, already stated on p. 44, that the swarm has chosen a home in a neighbour's empty hive. Any question of ownership can always be settled by an examination of the combs in this hive, for if there are no eggs or brood more than a few hours' old the bees undoubtedly belong to the claimant of the swarm, and he is entitled to their possession or their value. Should there be eggs or brood obviously deposited in the combs earlier than the day on which the swarm entered, then no claim can stand, for it is certain that it is impossible for the members of the swarm to be picked out from those already in the hive when they entered.

Handling the Swarm.—Should the swarm settle in a convenient position on a branch of a tree, it can be transferred directly to a bar-frame hive in the following manner: The hive, placed as nearly under the swarm as possible, should have the entrance to the body raised, and wedged, about an inch, and a board placed from the ground to the alighting board;

a sheet should be spread over this board and the ground under the swarm. The swarm should be shaken from the branch on to the sheet.

Should the cluster be in too awkward a position for this to be done, a skep will have to be brought into requisition for transferring the swarm to their new quarters. The cluster may be shaken into the skep by gently raising the branch from which it is suspended and then giving it a sharp downward movement. The skep should be held firmly and gently turned right side up over the sheet on to which the bees should be shaken in front of the bar-frame hive.

Should the bees be slow to run into the hive, those at the rear should be given a few gentle puffs from the smoker.

Sometimes the swarm will contain more than one queen and consequently will split up into several clusters. In such a case each cluster has to be "shaken" separately. Occasionally it becomes necessary to "shake" a swarm two or three times if the queen is not hived. It sometimes happens, too, that the queen will come out again if the hive is objectionable to her, and almost certainly so if she be a virgin.

As a rule, though, the old queen comes out with the first swarm, but I have known cases in which swarming has been delayed, when as many as five queens, including the old one, have come out with the first swarm. In a very strong hive a virgin queen will sometimes come out with a first swarm, but in such cases the swarm, as a rule, is a very small one.

The hive used for a swarm should be scrupulously clean and contain sufficient frames and combs for the requirements of the swarm. It is usual to place only one thin quilt over the frames for the first few days after a swarm has been given possession.

Hives containing newly placed swarms are usually allowed to stay until the evening of the day before they are removed, but, of course, if the situation is an inconvenient one, or if the hive is liable to be a nuisance to the public, it should be taken away at once.

If allowed to remain it must be sheltered from the rays of the sun or the heat will cause the bees again to issue forth.

Should a swarm not be required by the bee-keeper he must return it to the hive whence it issued very early on the morning following the day of swarming.

Each bee in a swarm usually carries sufficient food to meet its requirements for one day, so that should a bee-keeper receive a swarm from a distance he should feed it as soon as it arrives. All swarms should be fed if the natural supply of nectar be scanty.

Excessive Swarming.—Where bees are given to excessive swarming some bee-keepers trim one of the wings of the queen to hinder her flight,—a method also adopted to distinguish the ages of queens: the right wing of one year's queens being cut, and the left of those of the following year. Of course, the wings of a virgin queen should never be trimmed, for mating is thereby prevented.

Swarm Preventing.—The bee-keeper who works for surplus honey does all he can to prevent his bees from swarming, and thus increases both his stock of bees and supplies of honey.

Anyone who has even but slightly studied the ways of bees will have noticed that they store their honey above the brood in response to one of the wonderful instincts bestowed upon them by nature, and it is by taking advantage of this fact that the bee-keeper who is working for profit assures himself of one point of success. It is the method of

working standard frames from the brood-chamber as a super by which each hive is practically made into two—a queenless colony above and a brood stock below. I have tried pretty well all the systems used in England and have proved this to be the most successful in securing the purpose aimed at. For thereby the queen is given plenty of room in which to lay her eggs, and the bees plenty of accommodation in which to store their honey.

The method of working this plan is as follows. The bees should be stimulated in the spring and as soon as the weather is favourable to swarming the strongest hive should be examined. If the frames are seen to be covered by the bees, and almost full of brood or stores, everything is in order for the scheme. The essential point in it is the removal of the combs from the brood-chamber *minus the queen.*

A super of the same size as the brood-chamber should be prepared and a similar number of frames to those already in the brood-chamber duly fitted with empty combs or a sheet of foundation. The first frame is then removed from the brood-chamber, the bees shaken from it and placed in a super.

The "shaking" should be done by holding the frame about a foot above the hive and giving it a sharp downward and upward jerk to displace the bees. Needless to say, great care is necessary in the operation, as to drop the frame, or crush the bees, would lead to disaster. When the second frame is removed, an opportunity is afforded to look for the queen, which may be identified by her larger bulk and longer legs. Close attention must be given to see that there are no queen cells in the combs as they are removed, for the presence of a queen in the super is fatal to the scheme. All queen cells—easily identified by their acorn shape—therefore, should be removed from the combs.

After the third frame has been removed the empty ones should be inserted as each full one is transferred to the super, until the whole interchange has been effected.

The next proceeding is to place a sheet of queen-excluding zinc over the brood frames, so that no possible way is open for the queen to gain access to the super. The super is then placed in position and covered up. Should the combs contain any drone brood opportunity will have to be given them to escape after hatching, as they cannot pass

through the queen excluder. This may be done by rolling the quilt back for about an inch along the whole length of one side, on a bright, sunny day. The drones will soon find the opening and take flight.

If, after supering, the weather should be unfavourable for the bees to gather food, artificial feeding will have to be resorted to. Should the scheme be carried out early in the year and the queen be prolific, it may be found necessary to repeat it to prevent swarming.

It is necessary to remember that inasmuch as the rearing of young queens and the consequent swarming is not carried on under this method, it is a necessity that *the hives should be re-queened every two years.*

Queen Rearing.—It is better to retain one hive for queen-rearing purposes and this should contain the very best queen available so as to secure a good strain of workers.

The drones, too, should be selected by allowing no drone cells in any but the best hives.

For the small bee-keeper who cannot spare much time among his bees, and who only requires half a dozen queens in a year, I would recommend that queen-rearing should

be worked in with the standard-frame super method described in the earlier part of this chapter. If this course be adopted the procedure is as follows.

The hive should be allowed to come to swarming-point in order that queen cells may be formed by the bees. These should contain eggs or larvæ before the frames are transferred to the super, and all eggs or larvæ should be of the same age. This is an important point, for should one be hatched earlier than the others it will promptly destroy all the other queen eggs or larvæ in the frame. The wisest plan is to destroy all queen cells that are capped and the ages of eggs or larvæ noted in accordance with the information given on this point on page 13.

In working this method of queen-rearing, *the frames must not be shaken,* but the bees brushed off into the hive, otherwise the contents of the queen cells will be displaced.

The zinc excluder, of course, must be thoroughly applied to prevent the queen obtaining access to the super.

The super can be left until the day previous to that on which the first young queen is due to leave the cell. It must then be removed, with all the bees in it, and it should

either be split up or each queen caged in its cell.

After the super is split up, the bee-keeper should try to procure a swarm to divide amongst each part of the super—first running it through a queen excluder to catch the queen. These divisions should be given a separate hive if possible, but if it is necessary that they should occupy one large hive care must be taken thoroughly to separate each section and to have the entrances as far apart as possible. It is advisable, too, that the entrances should be of a different colour to ensure the young queens entering their own section, for should they by chance enter another a battle is sure to ensue with fatal results.

Re-queening the Hive.—As already stated, the method of working the hive with standard frames as a super necessitates re-queening every two years. There are several ways of doing this. One is to find the old queen and kill her, and allow the bees to install one of the young queens. This method, however, has many disadvantages. First of all, there is the disturbance to the hive in the search for the queen; secondly, if the queen be found and killed, there is a loss of nearly three weeks in the

height of summer when no eggs are laid in the hive.

Another method is to allow the hive to swarm and to return the swarm to its hive after destroying the queen. But this plan, too, has the disadvantage of checking the supply of eggs.

The best method for all practical purposes is to re-queen after the honey-flow, either with a home-reared queen or one purchased from a reliable breeder. The old queen, together with any queen cells in the combs, must be removed three or four days before the new queen is introduced.

The easiest way to accomplish the introduction is by means of a *queen-cage*. These are usually made of wood with three compartments, in the inner two of which the queen is imprisoned. The other is filled with soft candy. This cage is placed over the frames in the hive and the queen is liberated by the bees eating a way through the candy. By the time this is accomplished the queen will have acquired the scent of the hive and will be accepted as ruler by the community.

The hive should not be disturbed for at least four days after the introduction of the new queen.

"Shaking" a Swarm

Driving Bees.—After the honey-flow is ended, it becomes necessary to clear some of the hives and unite the bees with others. The old method of dealing with this matter was the drastic and wasteful one of putting the hive over the sulphur pit and wiping out the bees. The more economical, as well as humane, method of driving is now generally practised by the commercial bee-keeper. Driving is often accomplished immediately after the clover has finished flowering, and the bees sold to the bee-keepers in the heather districts, who are often glad to increase their stocks in readiness for the heather honey harvest. In other cases the driven bees are used to strengthen weak hives. In any case driving must be done before the autumn unless the bee-keeper is prepared to give the bees drawn-out combs and food to fill them with in preparation for the winter.

When driving is to be put into operation it is always advisable to remove the hive that is to be driven well away from the other hives, for the operator is far more liable to be stung by the bees from them than by those to be driven. An empty hive should be placed in the position occupied by the removed one : this will serve to attract any stragglers and prevent their flying away.

Another empty hive will also be required for the process, which is commenced by turning the hive which contains the bees upside down. Over this is placed the empty one—which should be of the same size—and the edge nearest the end of the longest comb is fixed on the lower hive by means of a knitting needle thrust through both edges. The opposite edges of the hives should be left about six inches apart, being secured in that position by means of driving irons or strong pieces of hazel sharpened and stuck into the edge of both hives at a different angle from that of the knitting needle at the back.

It is advisable, too, to fix a tea-cloth or a piece of similar material, so as to prevent the bees from running up the outside of the top hive. The actual process of driving consists in tapping the sides of the lower hive to which the combs are fixed, simultaneously with the hands. If the bees are slow to run the taps may be given at shorter intervals, while if they run freely the tapping may be lighter and slower. As a rule the bees will fill themselves with food before leaving the combs and it may be necessary to use the smoker to dislodge the stragglers; in this case only very slight blasts should be administered.

Transporting Bees.—When hives are sent any distance care must be taken that ventilation is afforded *above as well as below* the bees. The reason for this is obvious; there must be a way for the escape of hot air which rises to the top of the hive. This can be secured by placing coarse linen cheese cloth or a sheet of perforated zinc under a thin porous quilt.

All loose parts of a bar-frame hive should be made thoroughly secure before the hive is dispatched. Skep hives should be packed bottom upwards in a crate.

Swarms and driven bees should be sent away as soon as possible after swarming and driving are completed, for, as we already have pointed out, bees can only carry sufficient food to meet one day's requirements.

It should be an accepted rule, therefore, that when a hive is received from a distance the bees should be fed immediately.

When bees are moved about regularly from one district to another it is advisable that the hive should be fitted with a short alighting board and thus take up less space in the conveyance.

CHAPTER VIII

Feeding

In an erratic climate, such as that of Great Britain, bee-keeping includes among its duties that of bee-feeding at certain periods of the year, if profit is to accrue. It must be remembered that shortage of food when the bees are active means an inroad on their stores and a suspension of brood-rearing operations.

This applies most particularly to early spring when successful brood-rearing is absolutely necessary to ensure a profitable issue to the bee-keeper. If, therefore, there is a shortage of food then, the hive will be thrown backward to such an extent that the bees will have no time to gather surplus stores for the bee-keeper's benefit. All their strength will go to supply the necessities of brood-rearing. The honey-flow over, with their store so small that it serves their needs but a short time—for much food is consumed in summer—the bees then begin the pernicious system of rob-

bing other hives, and thereby causing further trouble.

Spring Feeding.—Spring feeding, therefore, may be looked upon as a necessity for the bee-keeper out for profit. It is then that the neglected hive so often succumbs after the community has existed safely through the winter.

I consider that outside feeding is by far the better method in the spring. For one reason it is always risky to disturb the bees by inside feeding early in the year, and there is always the certainty of admitting a draught of cold air to the hive. Another reason in favour of outside feeding is that it induces the bees to take exercise, which is decidedly good for them after the winter seclusion, and also keeps the young bees from wandering in search of food, and thereby running the risk of getting lost.

The food should be placed on a shelf at a good height from the ground, and in a warm situation, well sheltered from cold winds. Protection, too, is necessary for the food ; a garden light reared against the house wall answers the purpose admirably. The sun's rays passing through the glass will warm the food and make it more acceptable to the

bees. Old honey in the combs is of course the ideal food for bees, but where this is not available artificial food must be resorted to.

Syrup Food.—All artificial syrup food should be made from pure refined cane sugar, which supplies the bees with a substitute as near to the natural food as is possible. Syrup for spring feeding or stimulating should be made as follows:

Cane sugar	10 lb.
Water (clean spring water preferably)	7 pints
Table Salt	1 oz.
Vinegar	1 tablespoonful

This mixture must be boiled in a clean enamel saucepan and all scum that rises to the surface carefully removed. Some bee-keepers add a pinch of borax, or some naphtha beta, or other chemicals as preventives against disease, but unless disease be actually rife in the district these additions are totally unnecessary, especially in the spring of the year. Moreover they are liable to spoil the flavour of any surplus honey subsequently gathered by the bees.

It is only necessary to give each hive about one pint of syrup per week when spring feeding is commenced, but after a few weeks

the amount must be gradually increased. The worker bee generally leaves the cell about 21 days after the egg has been deposited by the queen, and as the young bee cannot leave the hive until she is a fortnight old, an increased amount of food is required after each batch of brood is hatched.

Artificial Pollen Food.—Many bee-keepers use artificial pollen in springtime for stimulating purposes. This consists of finely ground pea or oat meal, and is sprinkled among dry shavings or chaff in a box. A good method of attracting bees to such supplies is to place the pollen, etc., in an old skep hive which retains some propolis, or to place an old quilt in the box. In any case this food supply must be kept in a sheltered spot as directed on page 83.

Water.—A plentiful supply of clean water should be placed in the food shelter, for the bees use large quantities in the brood-rearing operations. In each gallon of water 2 oz. of table salt should be dissolved. The water should be placed in a glass jar which should be covered with a saucer and then inverted. Should the saucer be deep, some small pieces of wood or spent tea leaves should be placed in it to form alighting places for the bees. Another method of supplying water is to allow

it to drip from a small barrel on to a sloping board.

When to Stop Spring Feeding.—Artificial feeding must be stopped as soon as the bees are able to collect their natural supplies of nectar and pollen. This is usually about the time when the sycamore blooms, but in districts where crocuses or willows are plentiful it will be earlier.

Autumn Feeding.—It is when the honey-flow is ended, and there is no more natural nectar available for the bees, that feeding must again be resorted to if the bees are to be saved through the winter. The old method of allowing the bees to fend for themselves and stand the risk of starvation in the winter is now looked upon not only as unnecessarily cruel but absolutely wasteful. The slight cost of feeding them is amply repaid by the strength of the stock when spring once more arrives.

When the bee-keepers are working up an apiary from swarms, or driven bees, autumn feeding is essential, for it is very seldom that late swarms or driven bees are capable of securing sufficient winter stores without the assistance of the bee-keeper.

Food given in autumn should contain less

water than that given in the spring. The reason for this needs but slight consideration. In springtime when the days become increasingly warmer, and the temperature of the hive increases with the growth of the population, the bees need thinner food. The increasing heat of the hive would ripen thick nectar or syrup too quickly and give the bees extra work in collecting water with which to thin the food for the brood. In autumn, however, the tendency is to a falling temperature, and, though brood may be reared, the temperature of the external atmosphere will keep that in the hive down to the normal.

Syrup for autumn feeding made according to the following formula will be found to meet all requirements:—

Cane Sugar . . .	10 lb.
Water . .	5 pints
Salt	1 oz.
Vinegar	1 tablespoonful

When feeding bees for the winter all supers of frames should be removed from the hives, otherwise the bees are liable to form two clusters, and it is generally the case in such an event that one of these falls a prey to cold when severe weather comes. The supers above

the brood-chambers should be removed before feeding is commenced. If one is placed *under* the brood-chamber to give additional air-space the frames must be removed therefrom.

Winter Feeding.—If in winter the bees should be short of food, a cake of candy may be put in the hive, placing it on pieces of wood resting on the frames. The candy may be made in various ways. If some is required at short notice it may be obtained by mixing some castor sugar with a little thin honey into a stiff paste. If time will allow of the honey being heated so much the better, for the candy will then keep in good condition for some time.

A candy used by many bee-keepers for winter feeding is made by boiling 5 lb. of cane sugar in a quart of water for about 15 or 20 minutes. After the sugar has dissolved and the scum has been removed, the mixture should be allowed to boil briskly without stirring.

In order to ascertain when it has boiled sufficiently, a little should be taken in a spoon and dropped into a cup of cold water. Should it form into a soft ball on the bottom of the cup it is ready for "dishing up"; if it mixes with the water, the boiling must be continued.

It should be poured from the saucepan into a tin or enamelled pan to cool. As soon as it is cool enough for one to bear one's finger in it, it should be stirred until it is resolved into a stiff paste. The stirring breaks up the coarse grains of sugar and thereby makes the candy more acceptable to the bees.

Should the mixture, on testing, prove brittle or stringy it is evidence of over-boiling, and more water must be added until it boils to the proper consistency.

A little honey may be added with advantage after the mixture has been removed from the fire—but not before, or the whole will boil over and be wasted. The honey will often prevent the candy from becoming too hard to be of use to the bees.

When Bees Refuse Food.—There are times when the bees will refuse to avail themselves of food, and when such is the case it is certain that there is a reason for it. The bee-keeper should try to ascertain what this may be without unnecessarily disturbing the bees and provided that the weather is suitable to an examination of the hive.

Starvation is often a cause of bees declining the food, or, rather, not availing themselves of it. Hives that have been purchased may be

so short of food that the bees are too weak to exert themselves to get to the food supplied. In such cases the application of a little heat to the hive will generally work wonders. It may be done by warming some common bricks and placing them on the quilt, after closing the entrance to the hive. Care must be taken that the bricks are not too hot or the combs will be melted. Such a proceeding will sometimes revive bees that are practically dying from starvation, so that they will take full advantage of any food that is offered to them. This remedy may be applied in spring to moribund hives.

Fermenting or Granulated food in the combs are other causes of the bees declining to take other food. The first condition is usually brought about through excessive moisture in or around the hive. Honey that is gathered in late autumn, or syrup that is supplied to the bees, may not become sufficiently ripe in the cells to be sealed by the bees, and fermentation ensues.

Old Honey Stores.—If when examining the hives in spring it should be found that there is any considerable quantity of dark coloured honey left over from their winter store it is advisable to persuade the bees to use it for

brood-rearing. The cells in such combs should be uncapped and placed near the centre of the brood-nest. All old stores should thus be used up if possible, otherwise they may spoil the colour and flavour of the new honey.

Should anything be the matter with the hive or bees, try to rectify it; but, if the case be hopeless, burn or otherwise destroy the whole rather than run any risk of contamination to other bees from disease.

CHAPTER IX

How to Secure the Harvest of the Hive

As already mentioned, the use of the bar-framed hive is now considered essential to profitable bee-keeping, and in previous chapters many hints have been given as to the working of certain details connected with it. There are, however, matters connected directly with the gathering and harvesting of honey which have yet to be dealt with.

The Use of Comb-Foundation.—One of the most important items in the working of the bar-framed hive is the comb-foundation to which reference was made on page 35. It is by its use that profit reaping is made possible to the bee-keeper. Where it is intended to work combs on the standard frame principle, the foundation should be of the thick "worker" kind, for if the bees are not inclined to wax-making they will often thin down the thick foundation to obtain the wax with which to draw out the cells.

In placing the foundations in the frames,

particular care should be taken to see that the latter are accurately square. The foundation should be so placed that the angles of the cells point to the top and bottom of the frame, and the cells run in parallel lines thereto.

The foundation must be fixed firmly in the frame, and, to secure this, it is often advisable to drive one or two fine $\frac{3}{4}$ or inch nails through the top bar. Melted bees-wax should then be run in the sawgate for final security.

Wiring Frames. — Many bee-keepers wire the frames to secure a sure hold for the foundation. Personally I do not consider it necessary except under exceptional circumstances. The great objection I have to it is that the wire is bound to rust in time, more especially the parts that are not covered with wax, and the rust is sure to affect the flavour of the honey. It is well known that nothing is so detrimental to honey as contact with metal.

Should wiring be considered necessary, there are various ways of doing it. Some are content with two wires stretched across the width of the frame at equal distance from the top and bottom, and others take the wires across the length from opposite corners. In any case the wires must be pulled taut and

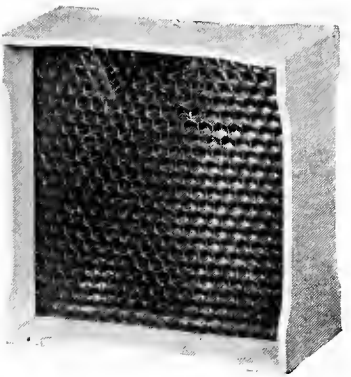
embedded in the foundation. A little implement known as an embedder is used for the purpose and has to be heated sufficiently to set the wire in the wax without unduly melting the latter.

An embedder can be made by rubbing or grinding obliquely the point of a fairly large nail and filing a small V-shaped groove at the end in which the wire can run.

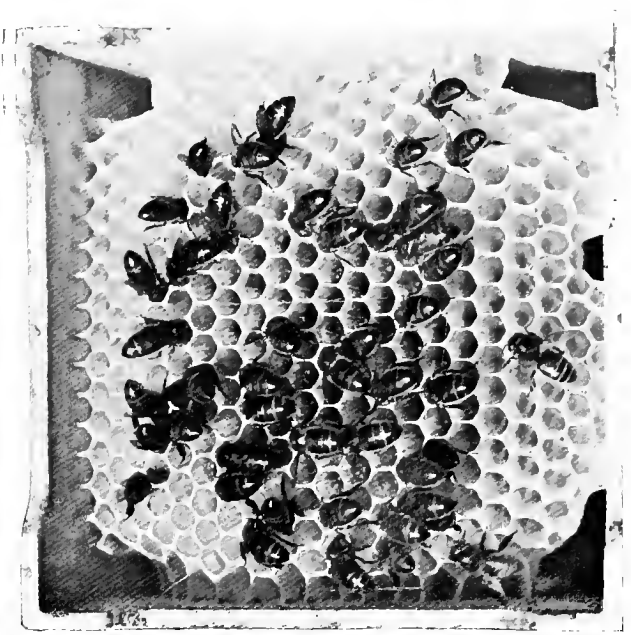
Hives of bees that contain frames recently fitted with foundation should not be moved if it can possibly be avoided, for the foundation is apt to buckle under the heat of the hive and may easily break away under the strain of a sudden jerk.

Section Working.—In working with sections for honey it is always advisable to use the thin foundation, for if there is nothing for the bees to start work on they will build combs of all kinds and shapes among the sections; many bee-keepers use drone foundation for the purpose. With the view, too, of confining each comb to a section, dividers (see p. 31) are placed between each row of sections. The use of the queen excluder, of course, is absolutely necessary to the success of section working.

It is often advisable when giving very



Section fitted with Comb Foundation



Bees at work on a Section

strong stocks sections to work to place a super of shallow frames immediately above the brood-nest, for the heat arising therefrom will often discolour the combs in the sections. In any case, to avoid this risk it is better to remove a crate of sections too soon rather than too late, for, in addition to the discoloration risk, it must be remembered that so long as the combs remain in the hive the bees will continue to add to the thickness of the cappings. As soon, therefore, as the cappings are sufficient to seal the cells effectually the crate of sections should be removed.

I do not advise the use of sections unless there is opportunity and facilities for the bees to fill these from one source, for sections never look well if they contain vari-coloured honey, and certainly the mosaic-like appearance consequent thereon is against them commercially.

The Care of Honey-combs.—The bees should be encouraged to draw out as many honey-combs as possible during a slack time in the beginning of the year. It means feeding the bees, of course, to do this, but, as brood-rearing is encouraged at the same time, the feeding is to good purpose. Honey-combs are a valuable asset of the bee-keeper—a fact

that is emphasised when we consider that it takes from 6 to 20 pounds of nectar to produce one pound of comb. Great care therefore should be taken of them when not in use and precautions taken to preserve them from the attacks of mice, moths, and predatory insects. In winter time they should be stored in an old hive in a dry situation, and small pieces of camphor or naphthaline should be placed in the bottom of the hive and in a saucer over the frames.

Mildew, too, has to be guarded against, but slight attacks of it may be remedied by placing the combs either in the warmth of the sun or near a fire.

The Honey.—One very important fact to remember is that no combs should be removed from the hive until the cells have been sealed by the bees. When the nectar is gathered and deposited in the cells it contains a certain proportion of water which must be evaporated before the honey is ready to be sealed. The bees know precisely when the moment for sealing has arrived, so that to secure the honey in good condition it is necessary to await this final operation. The rule cannot be—and is not—observed by bee-keepers who are short of supers, for they are often obliged to remove

one from the hive, take the contents, and return it to the hive fitted with new frames. This method of working is unsatisfactory from every point of view. Not only are the bees disturbed unnecessarily, but the flavour of the honey is not so good if taken too soon from the hive. Moreover, it is an accepted rule that honey should be extracted from the combs as soon as possible after it is taken from the hive, and if a bee-keeper is to be continually interrupting his normal work to remove and extract honey, he is giving himself far more trouble than is necessary if he is properly equipped.

It is, therefore, far better to leave the honey in the hive until the end of the honey-flow and deal with it as a whole.

CHAPTER X

How to Secure the Harvest of the Hive—(*Cont.*)

Extracting Honey.—The use of an extractor is a necessity to the bee-keeper who is working for profit, for chief among its advantages is that the honey can be separated from the combs without breaking them.

Uncapping.—When uncapping the cells, care should be taken to collect all the cappings in a tray or basket as they are removed, and they should be melted down as soon as possible after the extracting is completed.

Working the Extractor.—The side of the comb which contains most honey should be dealt with first, and in placing the frame in the extractor it should be seen that the bottom bar faces the direction in which the spindle revolves. The cells of the comb are usually built on an angle, and the honey will be thrown out of them quicker in this way than if they were placed to catch the air.

Great care is needed when extracting honey from new combs, for they are exceedingly

brittle. It is generally advisable, therefore, to turn the handle very slowly at first, and, unless it runs very freely, not to extract all the honey from a comb at the first operation. By partially emptying the one side and then reversing the comb the pressure on it is relieved gradually and the risk of breakage avoided. When the greater part of the honey has been extracted, the speed of the revolutions of the cages can be increased without any danger to the combs.

All honey should be extracted from the combs as soon as possible after they are taken from the hive, for it will run more freely then than after it has been allowed to stand and thicken, while its flavour will be better retained.

When a large amount of honey has to be extracted, the cleanest combs with the lightest honey should first be dealt with, and before the darker honey is taken the other should be run through the strainer and put to ripen, so that each kind shall be kept absolutely separate.

Ripening Honey.—After extraction, the honey should be placed in a suitable vessel in a warm room to ripen. After it has stood for a few days the surface will be seen to be

covered with a white scum—particles of wax and pollen—which should be removed as it forms. The honey immediately below is thin and watery. This is due to the proportion of water it contains, and measures must be taken to get rid of this by evaporation, or it will spoil the keeping property of the whole. To seal up any of this thin honey is to ensure fermentation and disaster.

The very best vessels in which to ripen honey are the large earthenware cream pots that are glazed inside. Being to a certain extent porous they allow for the evaporation of excessive moisture. They are, too, easy to clean and free from any possibility of metallic influence on the honey.

Straining Honey.—Strainers may be made of many variable materials from wire to muslin, according to the preference of the bee-keeper. Personally I have found that the most serviceable and effectual strainer material is soft linen cheese-cloth, and I would recommend that a good supply of it, ranging from coarse to fine in quality, should be kept by every apiarist for straining purposes, when broken comb has become mixed with the honey.

When the operation is necessary and a considerable quantity of comb has to be

removed, the following method will be found to be both simple and effectual:

A piece of coarse cheese-cloth, about four feet long, with the ends gathered and tied, should be held by two persons. The honey is poured into the middle of the cloth, under which is the vessel into which the honey is to drain. As the thin honey escapes, the cloth should be gently raised and lowered alternately at each end. This movement causes the comb and wax to move first in one direction and then the other and accumulate into a ball which constantly gathers up the particles of wax that in the ordinary way clog the strainer. By its weight and movement, too, it forces the honey through the cloth.

The old-fashioned strainers made from cheese-cloth in the shape of a fool's cap were effectual, but slower in their action than the method I have described. They had the advantage, of course, that they could be left to perform their work while other matters were attended to—an advantage to a cottage bee-keeper. They were made by cutting a piece of cheese-cloth square and sewing up the cross-cut to about three parts of its length, with one of the sides from the corner where they meet. After the seam had been run, the edge of

the cloth was turned over and hemmed to prevent the escape of any particles of wax with the honey.

To Strain Dense Honey.—Most bee-keepers have had experience of the difficulty of straining dense honey, and most of them are agreed that the old-fashioned method of squeezing it through a strainer is far from satisfactory. It is a tedious, messy process, calculated to try the patience and temper of the mildest of men.

The alternative method, though not perfect, is, in my opinion, far preferable. This is of heating the honey by the water-jacket principle to reduce its density. The great point in it, of course, is to apply just sufficient heat to affect the honey without melting the wax. Great care is needed in this respect, for if the wax melts and mixes with the honey straining is hopeless and the sale spoilt.

When dealing with small quantities the vessel of honey can be placed in a pan of boiling water on the fire. For larger quantities the extractor, or a large milk-can—provided it be not galvanised—may be used, and suspended over or in a copper full of boiling water. It is advisable, however, not to heat more than three inches of honey

at one time, for there is the liability of having the honey nearest the side of the vessel hotter sooner than that in the centre. This may be obviated to a degree by stirring it while it is heating. To avoid altogether the risk of overheating it is better first to warm the honey sufficiently for it to pass through a coarse strainer and then repeat the operation through a finer one.

Storing and Bottling Honey.—It is far better to keep honey in bulk than to store it in small bottles or jars, for there is no question that the flavour is thereby retained to a greater degree. It should be stored in a perfectly dry place, for it has the property of absorbing moisture. Especially is this shown in connection with sections, for they generally contain a few cells that are only partially filled or imperfectly sealed.

Marketing Honey.—In dispatching honey it will be found that the tin vessels supplied by the appliance makers are the most convenient, for they are light, and, if properly packed in a box or crate, are not very liable to damage. The bee-keeper who lives any distance from the market will find it more profitable to sell his honey in bulk rather than to bottle it for sale, for, after buying

bottles, allowing for carriage and breakages, the small apparent advantage vanishes.

Sections should be graded according to the colour of the honey and weight of the combs. Attractive cases may be obtained in which to place them, but before being put therein the sections must, of course, be cleaned of all odd pieces of wax and propolis that are generally found adhering to them when taken from the hive.

Bees-Wax.—Bees-wax is one of the by-products and has a certain commercial value for the bee-keeper. All pieces of wax, however small, comb and foundation, should be carefully preserved, and never wasted. They should be stored in an air-tight tin box, to secure them against the attentions of the wax-moth until such time as they can be melted down. Only comb of a very dark colour, or such as has the cells thickly coated with linings of cocoons, are not worth retaining and should be burnt forthwith.

Before melting the wax, it should be sorted approximately into light and dark varieties, and each melted separately. Combs from the brood-nest should also be treated separately owing to the additional straining required by the wax obtained from that source.

Wax extractors are made in many forms by various makers, but for ordinary use nothing excels the common earthenware jam or preserve jars, provided they are sound and free from cracks. Water should be added to the wax before it is treated, or it will burn in the jar.

Dark wax is saleable to tailors, and the lighter quality to manufacturers of foundation.

CHAPTER XI

Diseases of Bees

To understand thoroughly the life of the bee as exhibited in the hive is all to the benefit of the bee-keeper; for he will then quickly appreciate when matters are at all wrong with the bee communities in his care. He realises the necessity for keeping his stocks up to their full strength, for his knowledge tells him that they are better in every way for being numerically strong; they then keep warmer, consume less food proportionately than when the hive is weak, and give a far better return in brood and honey.

There are many infectious diseases to which bees are liable, most of which are due to bacilli and yeasts or ferments, and which receive untold assistance from inferior or fermenting food and unclean conditions in the hive.

These, then, are two conditions against which the good bee-keeper is always on guard. He is careful never to give fermenting honey,

or an excess of artificial pollen, when natural food is scarce, and especially to bar unsuitable food such as beet, raw or ill-conditioned sugar, and syrup.

He is scrupulous concerning the cleanliness of the hives, and allows no accumulations of wax, dirt, dead bees, or the presence of decaying matter of any kind. Most particular is he, too, to see that the roofs are thoroughly watertight, for he knows that any leakage is bound to engender mildew in the quilts and consequent fermentation in the combs. He believes in prevention rather than cure, for he knows that the conditions of bee life tend to spread disease with lightning rapidity should it once get a hold in the hive. Its hundreds of inhabitants confined in such a small space, each possessing air organs which penetrate every part of its system, afford every advantage to the spread of microbic diseases.

Should bees ever be seen vigorously fanning at the entrances to a hive without apparent cause, it is a sure sign there is something wrong, and examination should be made at once.

Foul Brood.—This is the very worst scourge to which the bees are subject. It is a disease that attacks the brood in the cells, and, as there are no young bees produced to take

the place of those that die, the hive is soon decimated. The disease is easily identified, for the whole of the cells attacked are perforated and of a brown colour, and a most offensive odour is produced.

The disease is probably spread by bees from an infected hive taking refuge in others, or by robber bees entering the infected one. There is nothing to do when virulent foul brood is discovered but to burn the whole contents of the hive.

Dysentery.—This is a disease which principally affects the older bees and is generally caused by feeding too heavily on pollen—more particularly in winter time when proper exercise cannot be taken. The symptoms are a distended abdomen, which is filled with a yellowish brown substance that is discharged copiously. In bad cases it is discharged on the combs.

The *best remedy* is to add an ounce of table salt to a quart or more of warm syrup and feed the bees outside in a sheltered spot.

Isle of Wight Disease.—This is one of the most mysterious and deadly diseases which affect bees. Further, it attacks the hives in winter when circumstances are all in its favour. Large sums of money have been

spent by bee-keepers, and a vast amount of time and thought given by pathologists in the endeavour to trace its cause and remedy, but hitherto without avail.

The *usual symptoms* are similar to those of dysentery, with a loss of power of flight. In attempting to fly, an affected bee falls to the ground in a helpless condition.

As in dysentery, however, it is the older bees that are affected; the brood and young bees seem immune. It would seem, therefore, that the winter feeding on pollen has something to do with it. Probably because pollen is more of a natural food to them, and because their air organs are not fully developed, the disease does not affect the young bees through that channel.

There are many so-called remedies which claim to be efficacious, but I have no faith in them except in very mild cases. I fail to see how a remedy can be administered when a hive is attacked in mid-winter and the bees are clustered, or when it reaches the stage when paralysis occurs. In such a case there is nothing to be done short of destruction.

If, however, a bee-keeper should have reason to suspect the conditions of a hive, and it is at all possible to feed it outside, I

would recommend that the method should be tried, for no harm would be done and possibly a certain amount of good. The food given should be thinner than usual—to counteract the effect of the farinaceous pollen food—and contain double the ordinary amount of salt. The hive should be cleared of any dirt, and the floor-board washed over with a weak solution of carbolic acid.

Should the combs become full of syrup as the result of this feeding, take some of them out and place them near the feeder, replacing them with empty ones.

The outside feeding encourages the bees to take exercise, which is all to their advantage, but it is not permissible where there are large numbers of hives in the district. In such a case a quilt of open material must be placed over the hive instead of the several thick ones, and inside feeding adopted.

Chilled Brood.—Although this cannot in every instance be accounted a disease, yet, unless care be taken, there is no knowing where an incipient case will end. The cause is suggested by the name—the brood in the cells becomes chilled, and the effect is death. As a rule, when this has happened the cappings of the cells become black, and the appearance

of an affected comb is something akin to that presented by foul brood. Whenever a hive contains any quantity of chilled brood, the bees should be given to another hive, and the queen, together with the combs, destroyed, unless the hive be a very strong one. In such a case the worst half of the combs can be removed and their space filled with a dummy.

If new combs are added it will generally be found that it is merely to afford facilities to the spreading of the evil. It is useless to add bees to an affected hive, for they will immediately fly away from the danger zone.

CHAPTER XII

Enemies of the Bee and Bee-keeper

Bees, and with them the bee-keeper, are subject to annoyance and depredations from many enemies in the natural world. Some make direct attacks on the hive and their contents, and others, by destroying or interfering with the food supply of the bees, sadly deplenish the stores for which the bees work and on which the bee-keeper's hopes rest. Among the former are insect-eating birds, spiders, moths, and other insects. Prominent in the other class are bud-eating birds and the green fly. Thus it will be seen that in both classes the enemies of the bees are also those of the gardener, so that no scruples need be felt in combating them with all the forces at our command.

The Earwig.—Among the most tiresome of pests is the earwig. The bar-framed hive seems to suit its requirements in every particular, and an opportunity is apparently never lost by it to enter and take possession. Any

empty combs that may lie within its purview are immediately commandeered for its own particular purposes—even when combs are kept for warmth in a super or section crate on the quilt inside the hive they are not safe from the ravages of this pest. Its eggs are deposited in the cells and the combs rendered useless.

One of the best traps for catching earwigs is the old-fashioned one of a plant-pot filled with moss and placed upside down on the end of a stake. The pot and its contents should be dropped into boiling water at regular intervals of a few days.

Mice.—Both house and field mice are included in the bee-keeper's black list. Their raids are seldom made in summer-time, especially if the hives are up to strength, but in winter it is no uncommon occurrence to find them in possession of a hive. It is probably the sweet scent and suggestion of warmth that first attract them to explore the hive, but once inside they begin the work of devastation. They are keen after the farinaceous pollen and demolish the combs to get to their stores.

The only effective way to prevent the entry of mice is to place a piece of zinc

perforated with holes just large enough to admit the passage of a bee, along the entrance to the hive to a height of $\frac{3}{16}$ of an inch.

Moths.—Moths of various kinds choose the hive as a suitable place in which to deposit their eggs, and the bee-keeper has need to keep a sharp lookout for the first evidence of their visitation, for, if not dealt with promptly, disaster is sure to follow. They generally deposit their eggs in loose bundles among the combs, and immediately the grubs are hatched they commence operations on the cells, which are rendered useless by their perforations. The sawgate of the frame is a favourite lodging of the moth, and the skep hive, of course, is a happy hunting ground for it.

The old-fashioned remedies — lavender flowers and camphor—are still esteemed the best for warding off moths, though naphthaline and chemical solutions are without doubt equally effective.

Ants. — The fondness of ants for sweet things is sufficient explanation of their raids on the hives. Where they are numerous it is advisable to stand the legs of the hive in tins containing paraffin oil: this is an effective means of preventing their climbing into the hives.

The Blind Louse.—This is a parasite fairly common in this country, and the bees, both hive and wild varieties, are favoured by it as hosts. Although it is said to be harmless, it must be treated with suspicion, and if its presence in a hive be detected steps should be taken to get rid of it. If tobacco smoke be blown into the hive, the parasite will loosen its tenacious grip and fall to the floorboard of the hive. Its destruction is then easy. Before the floorboard is replaced it should be washed with hot water into which a few drops of carbolic acid have been dropped.

Pollen Mites.—Amongst the smallest of the insects visible to the naked eye these little creatures work—as their name suggests—among the pollen stored by the bees. They are about the size of a grain of pollen and prefer the pollen when it is damp either with honey or water.

It is a commendable practice to keep combs that contain pollen by themselves when they are not in use.

Spiders.—In this country the spider is not to be so dreaded by the bee-keeper as it is in hotter climates. For cleanliness' sake, however, it is well to keep the hive clear of its webs.

Green Fly.—It is the bee-keeper rather

than the bee that has cause to dislike the green fly. To the bee, indeed, the aphis ranks as great a friend as it does to the ant. To both it is the excretion with which the aphis surrounds itself that is the attraction. To the gardener and the bee-keeper, however, it is an abomination to be warred against by all means at command.

The excretion of the aphis, popularly known as "honeydew," is white when at first sprayed out by the little creature, but after it is stored by the bee in the comb its presence is marked by a dark patch in the honey, and the bee-keeper knows that the latter is spoiled. This dark colour is attributed to a fungus generated by the honeydew. Where large quantities of honeydew are contained in combs the most economical method of dealing with the latter is to give them to the bees for drawing-out combs, for it is practically impossible to separate the honey, and for commercial purposes the presence of honeydew is prejudicial.

Occasionally honey that contains honeydew will crystallise, sometimes to look like a sponge, and in such cases the honeydew can be run off. If not so treated it will ferment and permeate the candied honey.

Wasps.—When particularly numerous, wasps

become a source of anxiety to the bee-keeper, and it is therefore to his interest to aid in keeping their numbers down as much as possible. The usual method is to destroy the nests before the queens are hatched out —which generally occurs about the middle of September.

Snails and Slugs.—Here again the bee-keeper and the gardener are at one in their efforts against common enemies. It is probably due to the trail of slime left by both slug and snail that the bees do not care to interfere with these intruders to the hive and leave them to roam about at their leisure.

The practice of using old honeycombs as bait or traps for these marauders is not to be commended, for their fermenting contents near the hives is in no way good, and may lead to ill, for the bees. Where snails and slugs are troublesome it is better to raise the hives at least a foot from the ground and clear away all grass and weeds in their immediate neighbourhood, sprinkling the ground with strong salt and water—or if the ground is to be fallowed, dry salt may be used.

Birds.—For the most part birds are indirect enemies of the bees, for they injure them by injuring the buds and flowers on which

they draw for nectar. Finches and sparrows are the worst offenders in this respect.

A bird that often makes a direct attack on bees, however, is the blue-tit, an insect-eating bird. When the winter is severe, and insects rare, the blue-tit will venture to tackle bees. Its methods afford a curious instance of the adaptability of wild creatures to circumstances. The general proceeding is for the blue-tit to alight on the front of a hive and tap gently with its beak at the entrance. The tapping attracts the attention of the inmates, and one is usually curious enough to investigate its cause. The bird seizes it immediately, flies off with it to a convenient branch, and, holding it down with one claw, with a quick motion abstracts the sting organs. That source of danger removed, "little Billy Bluecap" proceeds to peck off the head—which he likewise discards—and to lay open the thorax, the contents of which are all that he requires. From this, it is evident that blue-tits have developed an epicurean taste with regard to bees, and, when one has acquired it, it is astonishing the number of bees it will demolish to satisfy its cravings.

When hives are liable to such raids, perforated zinc, or small strips of glass, fixed on

edge across the entrance will often serve to frighten the birds off.

Another bird that raids directly on bees is the flycatcher, one of the migratory birds which come here for breeding purposes. Their usual swooping movement when catching insects on the wing is not practised when bees are their objective. It would seem that they avoid bees when flying. When raiding them, the bird alights at the back of the hive, and rushing under the alighting board, gathers up as many bees as he can from the ground in front of the hive.

It is quite possible that flycatchers could account for many a missing virgin queen.

The Toad.—Perhaps it is hardly right to class the toad as an enemy to the bee, seeing that the bulk of its food consists of insects that are injurious—either directly or through their larvæ—to vegetable or plant life. But, inasmuch as it varies its diet with bees when they can be obtained, we have included it in this list.

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